A HITCHCOCK PUBLICATION

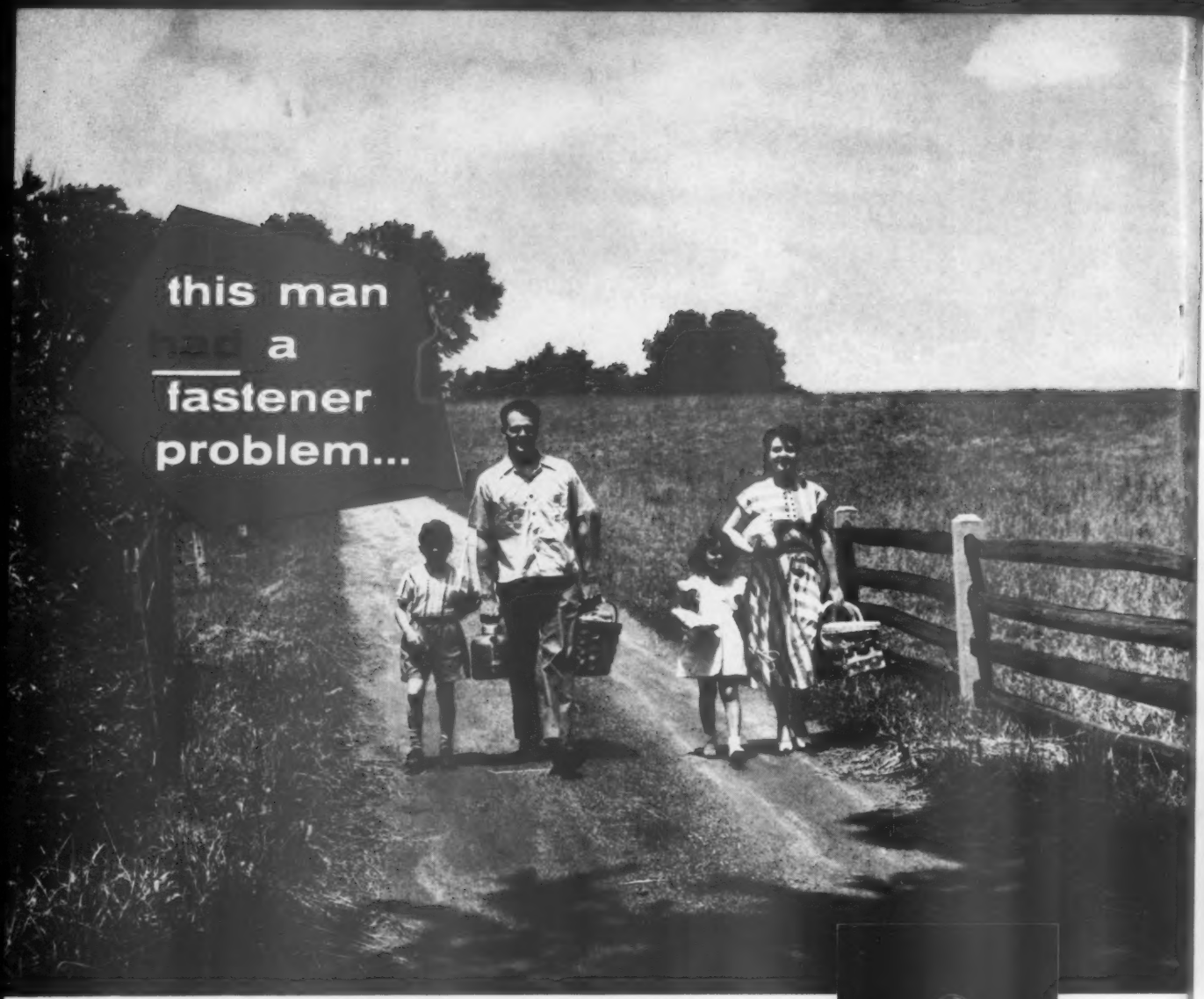
JULY, 1961—50 CENTS

assembly & fastener ENGINEERING

The role of stud welding in product design

Also in this issue: Structural Characteristics of Honeycomb Fasteners

How Altec-Lansing Assembles Hi-Fi Equipment



and here's how Pheoll solved it

It's no picnic . . . this rising cost of labor and material . . . especially to a cost-control engineer.

However, new ways are constantly being found to improve quality while cutting expenses. In this instance a cost-conscious engineer, working closely with a Pheoll Sales Engineer, discovered how he could save his company money on a brass terminal item.

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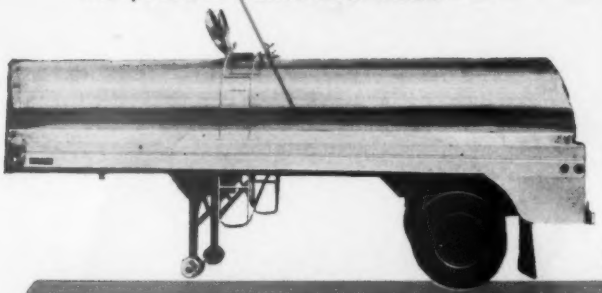
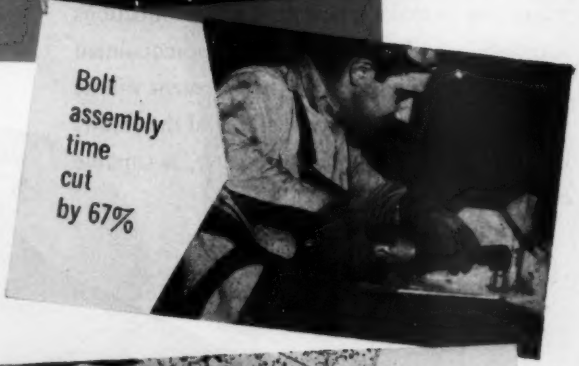
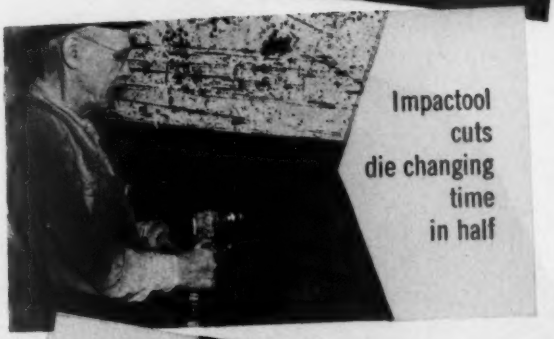
the product milk tank trailer

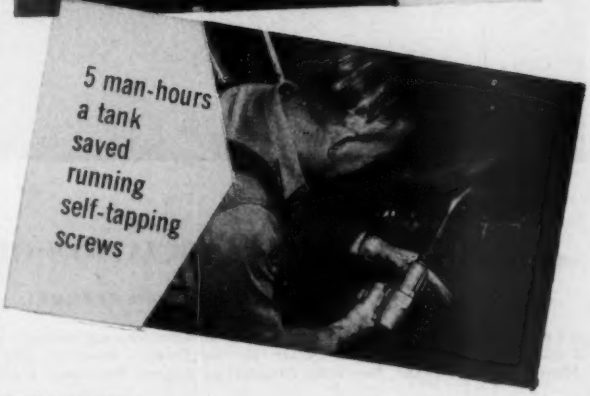


INCREASED OUTPUT PAYS FOR RETOOLING PROGRAM IN 58 DAYS...

NETS $58,000 DIVIDEND/YEAR!







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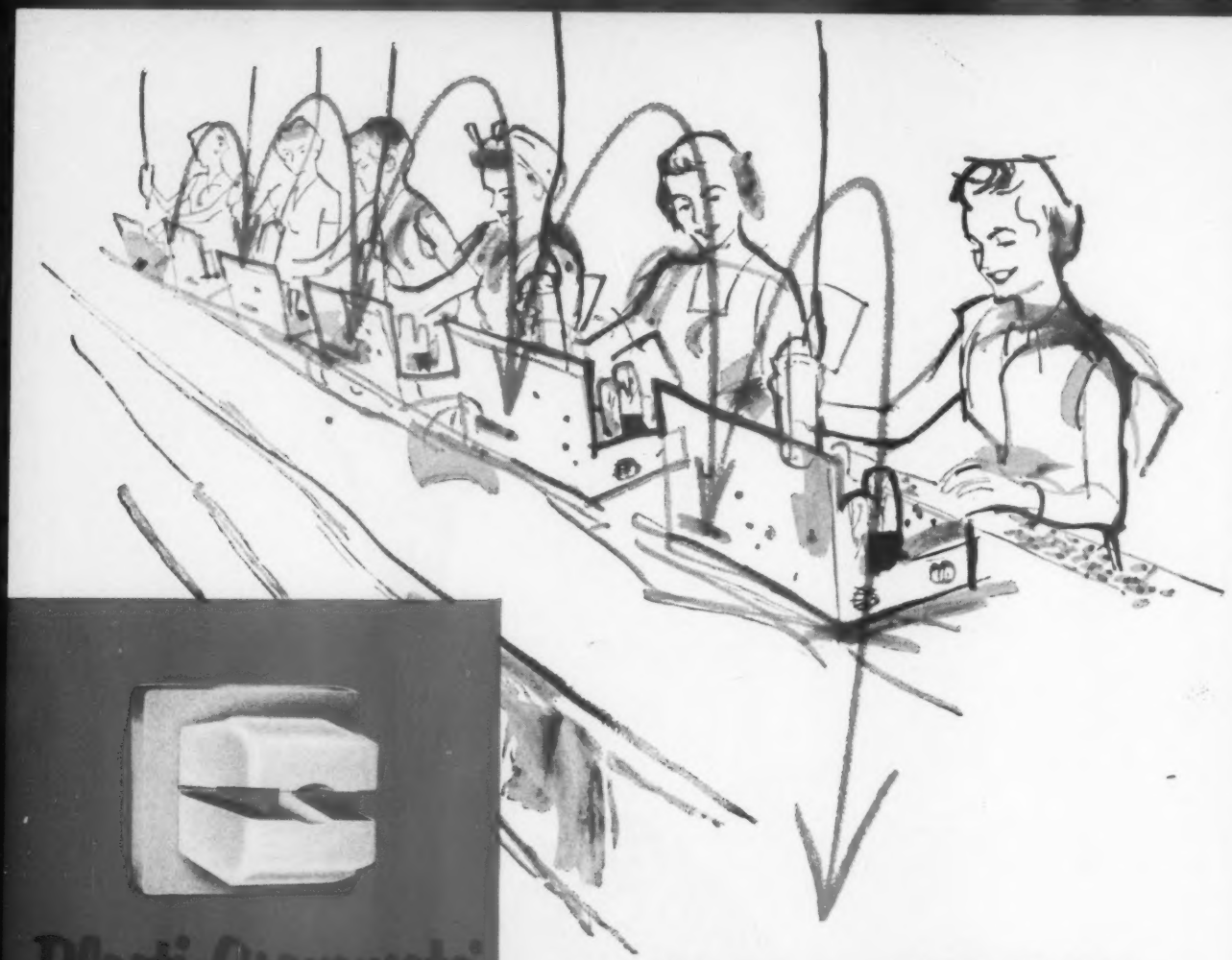

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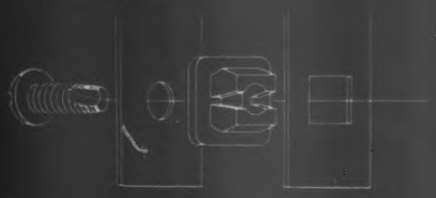

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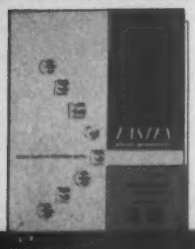

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assembly & fastener ENGINEERING

BETTER DESIGN AND ENGINEERING FOR ASSEMBLY

Volume 4, Number 7 July, 1961

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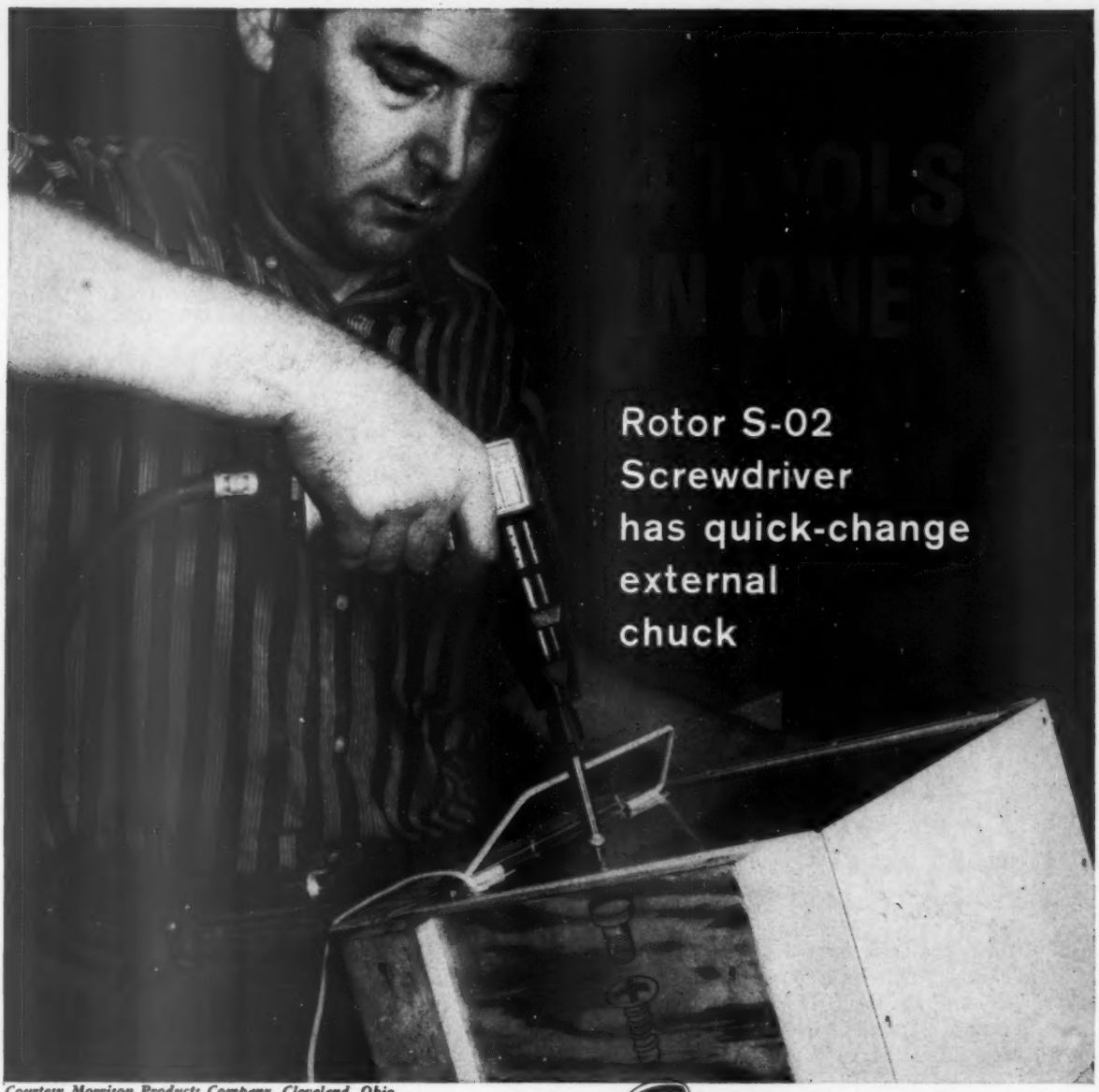

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Book Review

PRINCIPLES OF MFG. MATERIALS AND PROCESSES

"It is not enough that inventors and engineers be able to develop new machines and other products. After they have developed a new product, they must be able to manufacture it at a sufficiently low manufacturing cost. Each component part should be designed so that it can be manufactured at the lowest possible cost. This does not imply a so-called 'cheap' part. It means that the part should be correctly designed and manufactured."

This introduction to an engineering text written by James S. Campbell, Jr., Associate Professor of Industrial Engineering at the University of California, Berkeley concisely states the aims and purpose of the book.

It presents the subject of manufacturing materials and processes in the most efficient and effective manner, by pointing out the basic principles involved, and basing its approach on these principles by tying it in with other sciences previously studied by the design engineer, such as chemistry and physics.

Some companies may be well equipped to give further training to their engineers. On the other hand, many companies, especially smaller ones may not feel able to give this kind of training.

A great deal of time is spent on the "how" and "why" of such manufacturing processes and material selection as heat treating of metals, powder metallurgy, welding, brazing and soldering processes and measuring and gaging.

The book is profusely illustrated with line diagrams, charts and photographs of actual processes.

In the chapter on welding, brazing and soldering such subjects as classification of welding processes, types of joints, cleaning base metal surfaces and fluxes, edge preparation, gases in welds, forge welding, clad-metal sheets and plates, welding torches, oxyacetylene welding techniques, arc welding, atomic-hydrogen welding, stud and flash welding are extensively covered. The chapter also treats the basics of brazing, soldering and welding design.

The material used in this six-hundred page book has been carefully selected from the vast abundance available on the topic. An unusually large amount of information regarding the latest techniques and materials is included.

Engineers and designers, whether they are recent graduates, or at present actively engaged in the metalworking industry will find this book particularly helpful.

Principles of Manufacturing Materials and Processes may be purchased from Hitchcock Book Division, Dept. AFE, Wheaton, Ill. It is priced at $9.75 a copy.

inside corners

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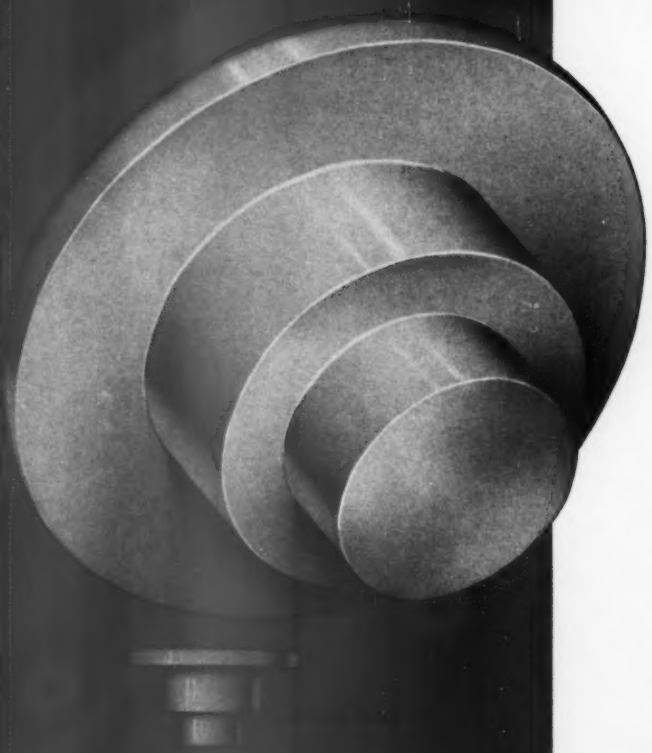
KEYSTONE WIRE *flowability* does it!



"Inside shoulders as sharp as possible," read the specifications for this shoulder rivet used in an automobile door assembly.

"Rockford"® Screw Products Co., Rockford, Illinois, makes this part from Keystone Direct Drawn Heading Quality Wire. In three blows, original .488" diameter wire is extruded to .379" diameter and severely upset to 1" diameter. The head is consistently formed without cracking while holding to head diameter tolerances of ±.010".

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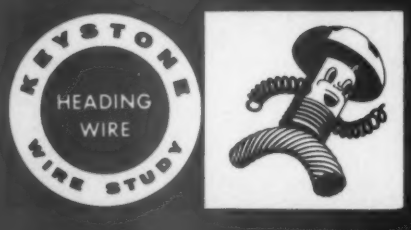
Our trained metallurgists and technicians are available to help solve your wire problems. Send us your specifications and we shall recommend the best steel analysis for you.

Keystone Steel & Wire Company, Peoria, Illinois



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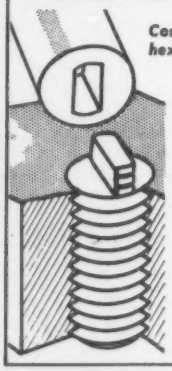

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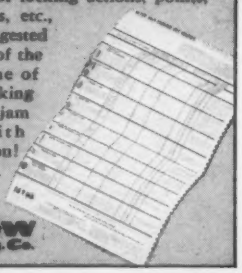

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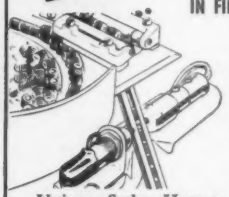
IDEA #6 "SETKO HOPPER FEEDER SAVED US $42,000 IN FIRST YEAR."



Here's the first truly Automated method of hopper feeding Headless Set Screws.

Unique Setko Hopper Feeder design orients headless Set Screws then feeds them to a driving device . . . Savings like the one shown above are but one of the advantages (name of mfr. on request) . . . Product quality is consistent, etc. This cost-cutting idea is one you can't miss! Check No. 6.

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IDEA #7 NOW YOU CAN GET COLD FORGED "PERFECT HOLE" CAP SCREWS IN THE NEW '60 SERIES . . .

and in STAINLESS STEEL, TOO!

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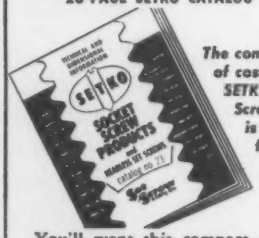
IDEA #8 THERE'S A BARREL-FULL OF IDEAS IN THE NEW 28-PAGE SETKO CATALOG #23.



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THE EDITOR'S VIEW

JULY, 1961, VOL. 4, NO. 7

IT'S A LOSING GAME FOR THOSE WHO WAIT

We came away from the recent Design Engineering Show more convinced than ever that business is only what you make it. Those companies which are tooting their horns loud and long through aggressive promotional activities are enjoying a higher level of sales in this recession than many who have pulled in their horns.

This point was brought out in our conversation with a fastener executive whose company had an impressive and well-trafficked booth at the show. This firm did something unusual in a recession year—they upped an already sizeable advertising budget. Why? Simply to promote new applications of their products to help offset the general slump in business. And it has paid off too, as much of their increased promotional expenditure has already been paid for in new business.

We found a similar attitude in another leading fastener manufacturer who like-wise had engineers swarming through their exhibit. Their sales promotion manager reported that their business outlook was never better. This company too is a strong believer in promoting new applications of their fasteners through a consistent and aggressive advertising and sales promotion program.

Neither of these companies believe in the waiting game, i.e. waiting for an improvement in economic conditions and hoping that some of this improvement rubs off on them.

Also, during the show we took a few minutes out to read one newspaper's roundup of business conditions. It was based on a series of short interviews with executives throughout the country.

One executive was asked if his company was placing any orders for new machine tools. His reply was, "We are waiting to see if our business picks up." This company is also playing the waiting game. Apparently, they need some new equipment, but are unwilling to make the cash outlay until prospective customers show some faith with signed orders!

What nonsense! Over-all business must inevitably improve, and improve in a big way. Those who prepare for it now will leave their competitors in the dust when customers signal a new era of prosperity. The waiting game is only for the lovelorn.

Matt E. Hensley

Editor

FAST, HAMMER-DRIVEN RIVET ECONOMICAL FOR BLIND AND OPEN APPLICATIONS

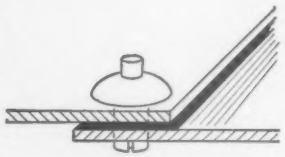

Fig. 1 Inserted in hole, Southco Rivets are quickly set by driving pin with hammer. No special tools are required. Bucking is not necessary.

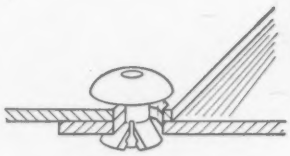

Fig. 2 Expanded prongs force sheets or parts together, hold them tightly in compression. No metal is removed, no grinding or finishing is required.

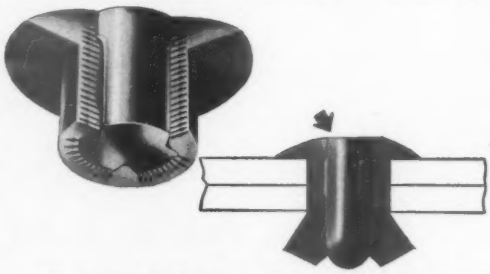

Fig. 3 Pin is locked securely into rivet by displaced metal filling unique grooves. Compression forces are utilized for greater strength.

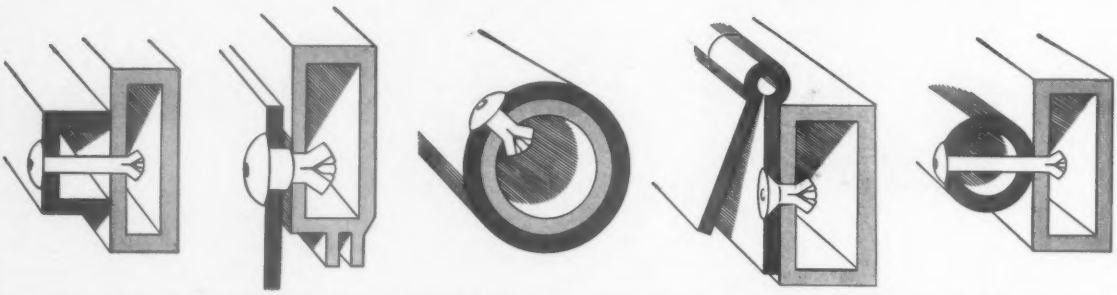

Fig. 4 Ideally suited for "blind" applications, Southco Rivets are worked by one man from one side only and require minimum space inside closed area. They eliminate costly bucking arrangement or time-consuming finishing. Supplied as a unit, they require no job time for assembly or fitting.

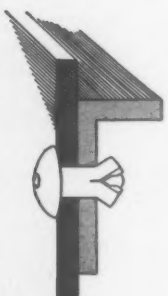

Fig. 5 Access or open fastening utilizes the simplicity, speed and vibration-resistance of Southco Rivets.

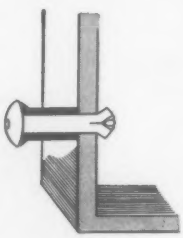

Fig. 6 Ferrules are used as spacers for numerous applications. Here the Southco Rivet forms a drawer pull in conjunction with a flanged tube.

Fig. 7 Increased head size distributes holding pressure over larger area, permits higher loading on wood, plastics and similar materials.

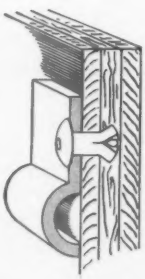

Fig. 8 A blind head can be formed inside the wood. This application is particularly useful when it is desirable to have one surface of the wood unmarred.

FREE

RIVET FOLDER

Send for your free copy of "Southco Drive Rivets" Folder. Gives complete information on the application, installation, and specifications of aluminum and steel Drive Rivets.

Write on your letterhead to Southco Division, South Chester Corporation, 257 Industrial Highway, Lester, Pennsylvania.

SOUTHCO FASTENERS

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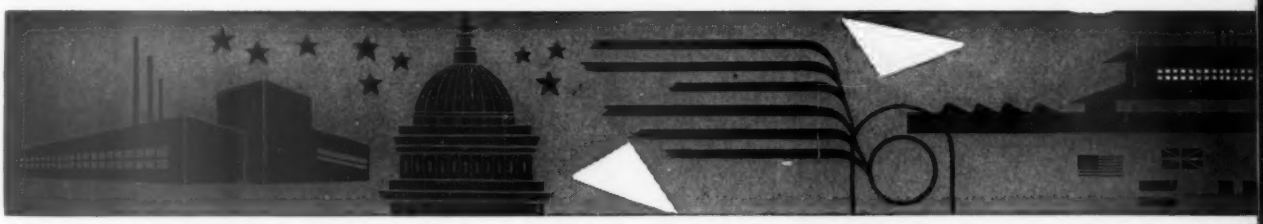
The State of Business



INNOVATION AND COMPETITION: KEY TO STEEL'S FUTURE

by **Roger M. Blough,** Chairman of the Board, United States Steel Corporation

I doubt if it is news to anyone in this country that we live in a highly competitive world. Certainly, our nation is more acutely aware of the cold war's competitive political challenge. In this conflict, fortunately, we have friends and allies.

We are also aware of the rugged competition in a world-wide contest for markets. In this struggle, however, American private enterprise must work out its own salvation. For it is precisely the competitive efforts of our international friends which pose our present challenge.

American industry, I believe, is second to none in many areas of technology and methods of manufacture and in our highly developed marketing and distribution system. To the extent that these things can be done profitably, they tend to encourage investment in plants and equipment here, which in turn provides jobs here for American workers.

We have, also, the potential of new and better products arising out of research and development expenditures.

But to maintain its competitive position in world markets, American industry must firmly resist anything which tends to increase the cost of its products and any effort to restrict the use of more efficient methods or tools of production. Such things tend to decrease sales, destroy jobs, and result in a profit squeeze, which in turn, discourages investment in facilities that could create more opportunities for employment here in America.

Steel companies in this country and Canada face the competition of burgeoning steel industries in many other regions around the world.

In 1940, the United States and Canada produced nearly 43% of the world's steel. At the close of World War II, it was about 60%, although the war and its destruction of foreign facilities was a factor in this comparison. In 1960, steel production in these two countries was about 28%, even though total production was 36 million tons greater than in 1940. Reviewing the growth in other major steel-producing regions around the world:

- Production in Western Europe, including the common market, and those countries outside was 54 million tons in 1940. Production in 1960 was 120 million tons.
- Steel production in Russia and it's European satellites has increased from 25 million net tons in 1940 to an estimated 95 million tons in 1960.
- In the Far East region, India and Japan's steel production totaled 9 million tons in 1940. It probably reached 28 million tons in 1960. Red China rose from less than one million tons in 1940 to about 20 million tons in 1960.

Blough has been chairman of the board of U.S. Steel since 1955. While at Yale, where he received his Law degree, he was editor of the Yale Law Journal. He is the recipient of 11 honorary degrees. He is a member of many groups and associations, including the AISI, Council on Foreign Relations and the American Bar Association.

Of course, not all competitors fly foreign flags. The challenge of other materials is always present in our rapidly changing technology and among shifting markets here and overseas. But, we cannot "wring our hands" about the situation, nor have we. After all, the answer to any competitor, be he foreign or domestic steelmaker, or the producer of a substitute material, lies, first of all in developing and keeping a competitive position.

To maintain our position in competition, as an industry and as individual companies, we must utilize, to the fullest degree, the concept of "innovation." By innovation, I mean, "the application of effective change"—an over-all quest for something better.

For steel, in general, the future is framed by the prospect of greater growth in production in the major steel-producing regions around the world.

A United Nations estimate of average steel production in the United States and Canada for the years 1972-75 is 176 million tons. Production in Western Europe alone in the 1972-75 period is estimated to be 178 million tons or about 10 million tons greater than the production for Russia and her Euro-

continued

pean satellites. In Japan and India, the 1972-75 average steel production is estimated to be 69 million tons. Red China's steel production could reach 57 million tons.

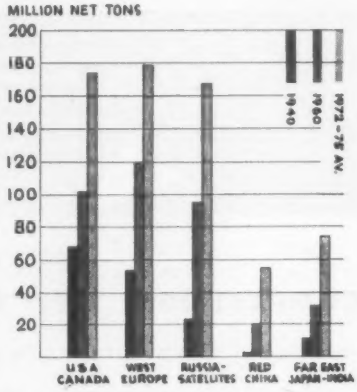


Chart compares steel production throughout the world. West Europe production includes all free European production. Figures for 1940 show only those countries which have remained in the European free economy. The 1972-75 estimated average of steel production is based on United Nation's estimate.

This world-wide growth in steel production presents an inevitable competitive challenge. It also indicates, by the mere fact that it is taking place, the increased opportunities for steel are certain to accompany greater industrialization—particularly as the revolution in technology, the explosion of population and the expectations of of peoples in Asia, Africa and Latin America continue at an accelerated rate.

Outside our borders we find that the consumption of steel mill products per person is lower than ours. Large segments of the world population now have available as little as 20 pounds of steel per person each year, compared with an average per person production in this country of over 1200 pounds annually.

Almost three-quarters of the world's people now urgently want the modern cities, automobiles, farm implements skyscrapers and shopping centers which are but a few of the many things in an industrial society requiring a backbone of steel. Thus the potential demand and world market for steel is virtually unlimited.

If American steel manufacturing is to capitalize on this potential, however, we must, obviously, be competitive.

We have done a great deal through innovation to be more competitive. But we must do more. We must gain, also, a greater understanding of some absolutely vital facts of economic life:

First, that increased costs and wasteful practices mean the loss of our competitive position. Specifically, I mean such things as employment cost increases and restrictions on the use of more efficient equipment and methods resulting from progress in technology.

Some people erroneously attribute present unemployment to automation. It is far more accurate to say that recent unemployment in steel resulted primarily from a downturn in the consumption of steel. Other economic factors contributed, particularly the cost pressures, which detracted from the ability of American producers to compete in the world markets.

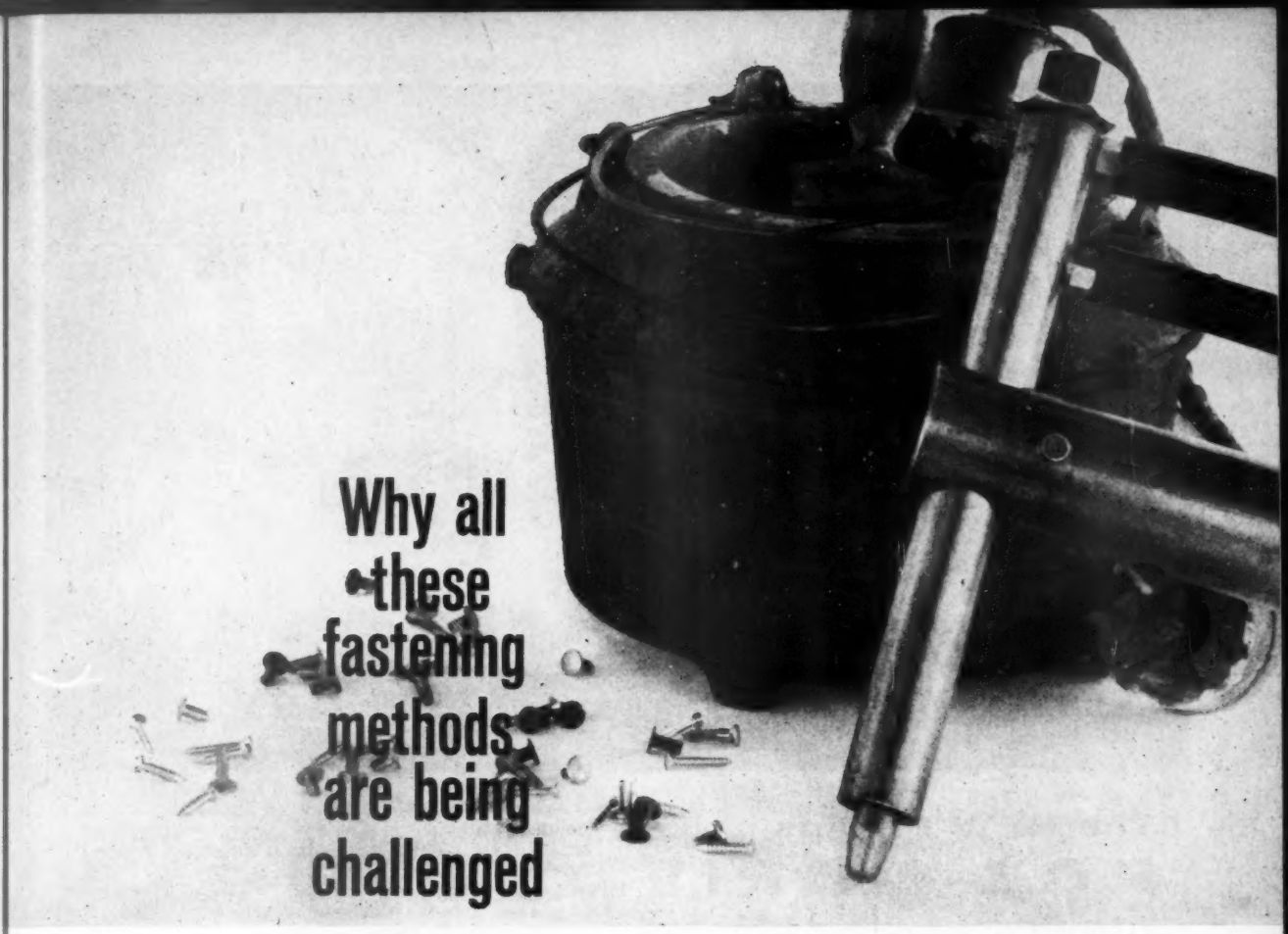
Second, that less profit means fewer and poorer tools, and this means the loss of our competitive leadership which, in turn, means declining sales and fewer jobs. In this increasingly competitive world, a profitable American enterprise is the greatest security for a job here in America.

As a nation, we must gain greater awareness of these essential, economic facts. They point the way to holding and improving our position and to success in world trade. This will contribute toward a more favorable balance of international payments and help put more Americans into productive jobs. It has been estimated that each billion dollars of exports creates 100,000 American jobs.

Today and tomorrow, we, at United States Steel, plan to go on examining everything we do, no matter how hallowed by past experience, to find better ways to compete. Innovation is above all, an open-minded receptivity to change and we believe that this attitude and the accomplishments that stem from it can help us win in the world-wide contest of competition.

We live and strive in a highly competitive world, a world in which innovation, competition and steel mark the future. •

This article based on Mr. Blough's remarks at U.S. Steel's annual stockholders meeting.



Why all these fastening methods are being challenged by this one

Acme Steel Wire Stitching offers savings so pronounced, versatility so great, it is replacing riveting, preformed stapling, spot welding, threaded fastening and adhesion methods in even the most unusual applications. High-speed Acme Steel Wire Stitchers take wire directly from a coil—*cut* it . . . *form* it into proper size "staples" . . . then *drive* thousands of them automatically without a moment's pause for reloading. Wire stitches form their own holes, completely eliminate pre-punching, tapping, drilling, aligning rivets to holes and screwdriving. Results: many combinations of metallic or non-metallic materials can be secured with uniformly high fastening strength and speed . . . lowering fastener costs as much as one-half, speeding productive output 500% or more!

Wire stitching is no cure-all. But, an objective analysis by men who know the most about it will tell if it is feasible for you. Simply return the coupon with samples of materials you wish fastened.

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The NEW Phillips
POZ-I-DRIV
a revolutionary new fastening development.

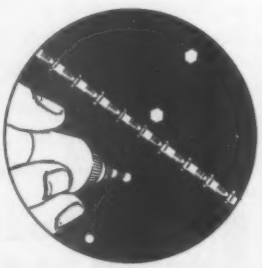
In 1933, American Screw Company gave industry the famous Phillips cross-recessed head, a fastener design that revolutionized assembly operations. And now, American presents the new POZ-I-DRIV fastener recess and driver . . . a development that offers significant reductions in assembly time and costs, increases fastening strength, improves product appearance and performance, and boosts profits.

The new POZ-I-DRIV recess is similar to the Phillips design, but provides greater driving area with reduced recess depth. This combination produces several significant advantages, including:

1. **GREATER TORQUING ABILITY** . . . making it possible to drive threaded fasteners tighter at continuous production speeds because of reduced operator fatigue.
2. **BETTER DRIVER-RECESS ENGAGEMENT** . . . practically eliminates cam-out, reduces bit wear, prolongs bit life.
3. **INCREASED DRIVING AREA** . . . with better driver stability permits shallower recess resulting in increased head strength.
4. **IMPROVED AXIAL ALIGNMENT** . . . and positive bit engagement permit 90° offset driving.
5. **COMPLETE COMPATIBILITY** . . . with present Phillips bits for field service.

AMERICAN SCREW COMPANY
Leader in Fastener Development

Since 1838, American has been making important contributions to industrial progress by the continued development of new and better threaded fasteners. Here, for example, are 3 recent developments by American Screw Company:



SCREWSTICK . . . consists of machine and fluted thread-cutting screws in "stick" form. Used with automatic-feeding driving tools, they can be applied as fast as the operator can position the assembly. Available in steel, brass, aluminum, nickel silver and stainless steel alloys.

TORQ-SET . . . designed for the expanding needs of supersonic aircraft, missiles and electronic components, where maximum wrenchability and reliability are of prime importance. Recess design eliminates burring that would interfere with laminar flow.

TRI-WING . . . a tamper-proof fastener, which is virtually impossible to remove without mating tool. Designed for maximum security against tampering or pilferage. With high torquing characteristics for applications requiring extreme strength or vibration resistance.

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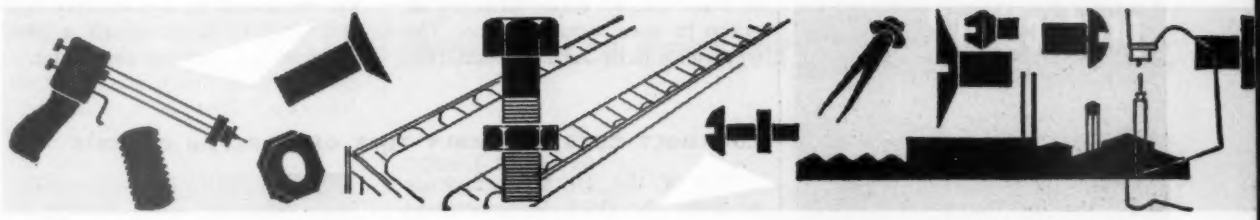
Ideas and Field Reports



NESTING-STACKING TRAYS IMPROVE ASSEMBLY, MATERIALS HANDLING

Stockroom space is conserved by stacking trays close to ceiling. Wire stacking rods support trays rigidly and prevent mis-alignment. These nesting stacking trays are equipped with hardwood runners which add rigidity and act as guides for skate wheel conveyors.

By switching its assembly methods for small air circuit breakers, the Small Air Circuit Breaker Division of I-T-E Circuit Breaker Co., of Philadelphia increased its production.

Formerly, they loaded metal trays with phenolic moldings and passed these trays through a number of assembly stations where component parts were added. To speed up assembly and cut out laborious manual handling of trays, a conveyor was installed to carry these moldings through the stages of assembly.

While production increased sizeably, it was difficult to maintain an even supply of moldings and component parts to the conveyorized assembly line. These components were stored in a variety of containers, metal utility trays, wooden boxes, etc. Metals trays of sufficient capacity were too heavy for women employees, and wooden boxes required constant repair. Also, many sizes and types were in use, which made it difficult to estimate accurately the number of parts each container held.

One of the biggest drawbacks was the amount of floor space these miscellaneous containers required. Since they couldn't be stacked, they had to be spread out one or two high.

To improve their materials handling, the division drew up a set of specifications for a standard container. Working from these specifications, a vulcanized fibre nesting-stacking tray made by National

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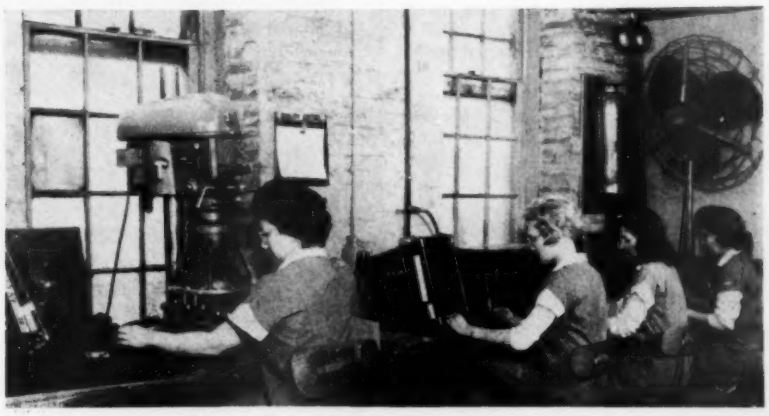


Trays are lightweight and convenient for women workers to handle. Here, trays of phenolic moldings are processed to remove flash from holes and recesses.

Vulcanized Fibre Co. of Wilmington, Del. was selected to do the job.

The trays used are equipped with stacking rods which permit a large number of filled trays to be stacked up without danger of collapse. Nesting stops at the sides make it easy to stack empty trays vertically in order to save storage space. The trays also have hard wooden runners, which act as guides for skate wheel conveyors.

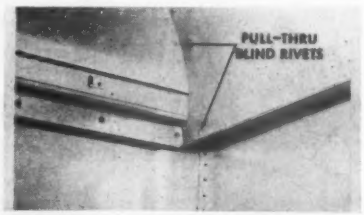
Inventory count and control is also aided with the use of the nesting-stacking trays. As an example, stockroom workers know that 40,000 pieces of one type of part will be found in a level tray. All they need to do is attach a label showing part number and count.

LOCKBOLT CUTS ASSEMBLY TIME OF SWEEPER CHASSIS

Use of the Huckbolt fastener made by the Huck Manufacturing Co., Detroit, Mich. solved an assembly problem in the chassis of an airport runway vacuum sweeper.

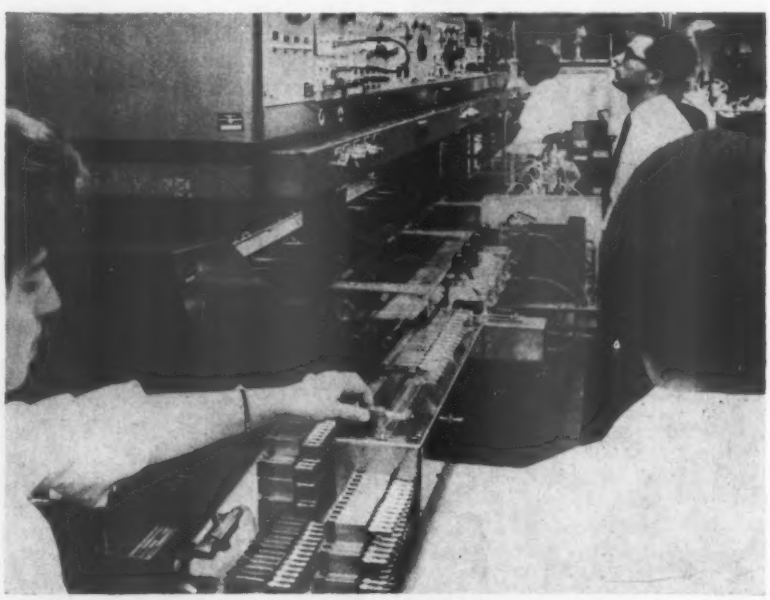
The chassis cross members and angle braces of the sweeper are fabricated in ¼" thick ASTM-285 tempered steel plate, which does not weld satisfactorily.

Engineers at Jet Ground Equipment, Inc., Atlanta, Ga., producers of the Turbogard sweeper, selected the Huck fastener for all permanent structural joints.



In blind applications, where the work was accessible from one side only, 3/6" dia. pull-thru blind rivets were used as shown.

TRANSISTORS MASS PRODUCED AUTOMATICALLY



Carrier blocks holding tiny wafers of germanium are placed on moving belt that takes them through electronically-controlled automatic etching process.

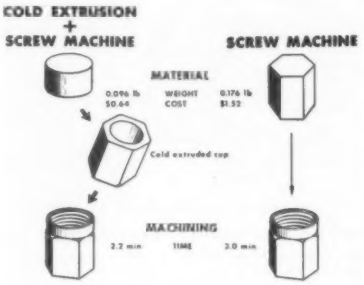
Operating in an air-conditioned, dust and temperature controlled atmosphere, a fully automatic assembly machine produces "second and third generation" transistors and other semi-conductor devices.

Installed in the recently completed General Instrument Corp. plant in Hicksville, N.Y., the assembly area is designed to permit

fullest production flexibility for different types of semi-conductor devices.

TITANIUM FASTENERS MADE BY COLD EXTRUSION

Low cost manufacture of titanium fasteners has been made possible with cold extrusion techniques developed by Battelle Memorial Institute, Columbus, Ohio, for the Manufacturing and Materials Technology Division, Air Materiel Command, U. S. Air Force.



Comparison of fabrication methods for No. 10 size flareless tube nut of AMS 4902 titanium. Technique was developed by Battelle Memorial Institute for Air Material Command.

The titanium part used in a pilot run at Battelle was a No. 10 size hexagonal nut for MS-type aircraft quality flareless tube fittings. These fasteners are normally produced in steel or aluminum entirely on automatic screw machines.

Production of titanium fittings by machining has been so costly that their use has not been justified. The Battelle process has cut this cost almost in half.

Full size hexagonal cups were backward extruded in a single operation from solid cylindrical AMS 4902 unalloyed titanium billets 1" diameter by ⅜" thick.

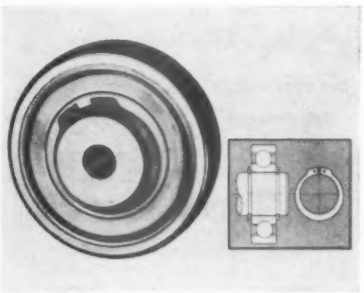
Not only is the starting billet used in cold extrusion only half the weight of the one needed for screw machining, but it also can be cut from round barstock instead of the more expensive hexagonal barstock.

Comparing over-all manufacturing costs, preforming the nut by cold extrusion and finishing on an automatic screw machine yields a net cost saving of 48.5% over the conventional method of making the nut completely by screw machine.

continued

HEAVY-DUTY RING HAS HIGH THRUST, IMPACT CAPACITY

A heavy-duty, external-type retaining ring is designed for assemblies subjected to extreme load conditions. It has a high thrust load and impact resistance and provides a shoulder sufficiently high to retain parts having large corner radii or chamfers.



Heavy duty retaining ring designed for assemblies subjected to extreme loading conditions. It provides a shoulder sufficiently high to retain omponents having large corner radii or chamfers.

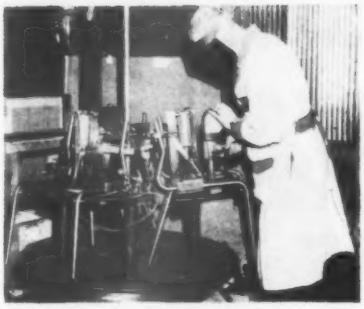
The series 5160 ring, developed by Waldes Kohinoor Inc., of Long Island City, is especially suitable for retaining bearings. It may be used without spacer washers to secure all ball bearings, tapered roller bearings and cylindrical roller bearings.

Because of its high load capacity, the new ring may be used to replace heavy-duty nuts, machined shoulders and other bulkier fastening devices used to secure components on shafts, axles and similar structural members. The fastener is expected to be used widely in automobiles and trucks, farm and road building machinery and other heavy-duty applications where conventional retaining rings do not provide the necessary thrust and impact resistance.

ROTATING FIXTURE WELDS 3 CHAIR FRAMES PER MINUTE

Three chair frames per minute are welded on a three-position, rotating fixture devised by Queen City Dinettes Corp., of Cincinnati. Six welds per chair are made by the operator who stands in one position.

The tripled production rate was made possible through the replacement of stick electrode welding with semi-automatic equipment made by Westinghouse Electric Corp. of Buffalo.

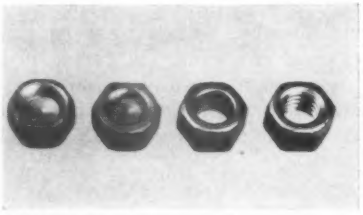


Operator stands in one position to weld three chair frames on rotating fixtures.

The Queen City plant uses the equipment on 16 to 20 ga. steels, including chrome plated and variously painted steel tubing, which is used for its Duchess line.

IMPROVED STAINLESS STEEL FOR COLD HEADING

Quality cold heading properties of No. 10 stainless steel made by Carpenter Steel Co., Reading, Pa., solved a hexagonal nut production problem for Detroit-Diamond Screw Products Co., Wyandotte, Mich.



Cold headed hex nuts made from No. 10 stainless steel.

Other stainless wire grades previously used to make the hex nuts were unsatisfactory because these materials work-hardened too rapidly. Thread tapping was difficult and the reject rate was high.

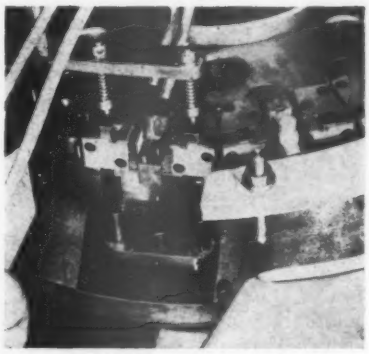
Use of the No. 10 stainless steel increased the production rate, and the reject rate was lowered considerably. In addition, use of the steel eliminated one annealing process which was required with other stainless grades.

Stainless No. 10 is a modified austenitic, chrome-nickel steel that is particularly useful for cold headed and upset parts because it work hardens much slower than any of the conventional 18-8 analyses steels.

DOUBLE WEDGE FIXTURE CENTRALIZES CASTINGS

A double wedge fixture centralizes and clamps small ferrous castings for drilling, threading, tapping and

continued



Close-up photo shows double wedge fixture used for centralizing castings.

hollow milling operations on a dial type machine made by Bodine Corporation of Bridgeport, Conn.

Three different valve body castings are machined with the same tooling by changing the serrated clamping jaws. Parts are run through the machine twice. The first pass machines one horizontal lug and the vertical lug; drilling, hollow milling, threading, or tapping as the specific valves require. The part is then run through again to machine the other horizontal lug and deburr the vertical hole for any break-through burrs.

The valve bodies are fed manually and a retaining strip holds them in place until they are clamped by the toggle clamp unit. The fixture centralizes and repeats to .001".

ROTATING ELECTRODE GIVES HIGH TENSILE WELD

Lightweight automatic gun used to weld steam condenser tubes to tube sheets in nuclear power plant being built for Consolidated Edison Co., New York.

A welding gun with a rotating tungsten electrode is being used to weld tubes to tube sheets, giving

them a leak-proof, pressure-tight joint.

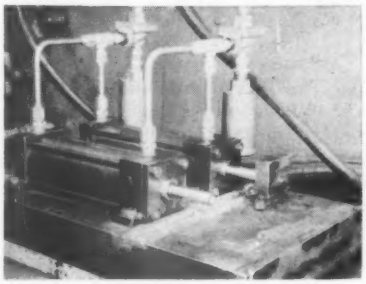
The gun, designed by the Research Department of Revere Copper and Brass Inc., Rome, N.Y., may be used for joining any two compatible metals.

The rotating mandrel of the gun is inserted into the tube to be welded in such a manner that complete accuracy between the path of the torch and the periphery of the tube is maintained, with complete independence from slight inaccuracies in tube sheet drilling.

Rotation of the mandrel is accomplished by means of a flexible cable from a variable speed motor located at the power source.

The gun, which weighs 6 lbs, has been selected by the Consolidated Edison Co., of New York for use in welding tubes to tube sheets in the steam condensers of its new nuclear power plant at Indian Point, New York.

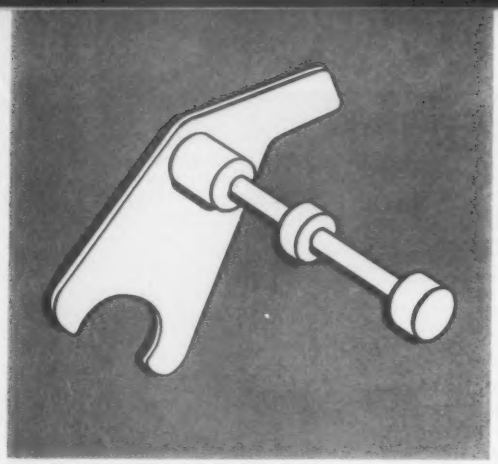
STUD ENDED PISTON ROD RESISTS FATIQUE FAILURE



A new type piston rod which uses a stud end is proving at least 40 times more resistant to fatigue failure than conventional ⅜" diameter cylinder rods.

In laboratory tests at Hydro-Line, a standard style No. 4 internally threaded ⅜" diameter piston rod with 7/16"-20 stud end held up under 60,000 continuous impact cycles without cracking and also without other visible or measurable deformation. A standard rod design of the same size and thread broke after approximately 1,470 cycles.

The studded rods eliminate stress concentrations which form at thread reliefs on conventional rod designs. These stresses are critical when the cylinder and work are misaligned, and are a common cause of cylinder failure.

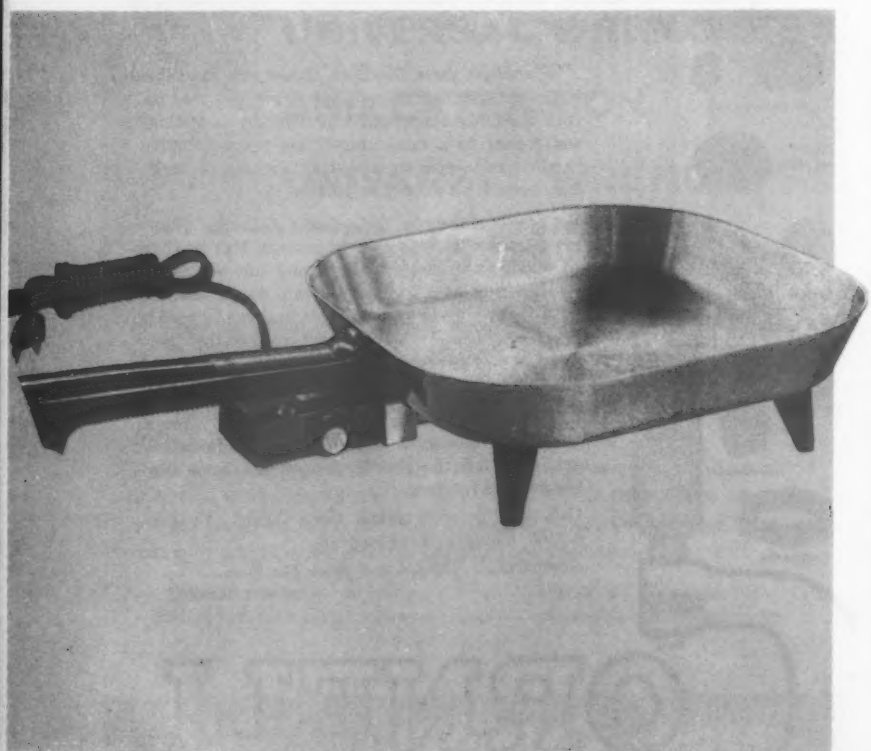


Automatic transmission part consists of a centerless ground type B-1112 stem welded to a 1010 steel base.

by **Frank Wille**
Service Manager
Omark Industries, Inc.

The Role of Stud Welding in Product

Presenting examples of the application of both threaded and unthreaded weld studs in several types of end-products. Included are recommendations for the selection of both base and stud material.



An example of a stud especially designed to meet a specific requirement is contained in Toastmaster's electric fry pan (see photos on opposite page).

Few engineers need to be reminded of the difficulties involved in fastening thin structural or decorative sections. The problem is even more apparent when design specifications call for exterior surfaces to be free of screw heads or other protrusions. If there are added requirements for the use of stainless steel, decorative brass, polished or plastic-clad aluminum or galvanized sheets, the design problems appear to multiply rapidly and costs zoom out of proportion to value.

One solution to many such design problems lies in the percussive stud welding system. Employing a high arc density and a short time cycle, this stored energy system can weld studs to thick or thin materials. Properly applied, the stud can be securely welded with freedom from distortion, burn-through or marring of the opposite surface.

Some of the economies from stud welding include the following:

The studs are relatively inexpensive, ranking in initial cost with comparable standard fasteners.

Studs may be rapidly and accurately located and welded by com-

Here a 5/16" square aluminum stud with an internal thread is welded to an electric fry pan. The handle is then attached to the stud.

paratively unskilled workers.

Base materials with moderate surface oxidation do not require cleaning prior to welding; flux is not used on either the stud or workpiece.

Finished surfaces opposite the point of weld remain bright and free of distortion or shrinkage marks.

The equipment can handle a full range of stud sizes—No. 2 to ¼" diameters and from ⅜" to 5½" in length.

Round shapes of special contour can be welded. (Structural soundness of the weld allows the use of the system in the fabrication of parts for working mechanisms.)

WELD COMPATABILITY

The percussive welding system allows a wide range of selection in specifying the base and stud materials. Chart I illustrates our company's recommendations.

These base and stud material combinations are considered to be standard. Other combinations which achieve accurate and economical welds may also be worked out. Adaptation of some rare metals to the process is an example of the system's versatility.

BASE MATERIAL SELECTION

Rapid and accurate welds are obtained under a variety of base material conditions. As the welding machines have a wide range of voltage adjustments, ordinary surface contamination is blown out of the weld area by the corona, as the arc is drawn. Hot rolled structural, mild or low carbon steels are readily utilized as base materials without prior surface cleaning. Galvanized or lightly painted mild steels are welded in the same manner.

The high arc density creates a corona which readily cleans the weld area. The ionized zone, built by the arc, acts to exclude atmospheric impurities from the weld area. The fusion of the stud and workpiece is then performed under ideal conditions.

STRENGTH CHARACTERISTICS

The exclusion of impurities from the weld area automatically obtains full strength in the fusion zone. Characteristics of the weld strength are consistent with those achieved by highly skilled welders, working under ideal conditions. The strength of the assembly is influenced primarily by the thickness of the base

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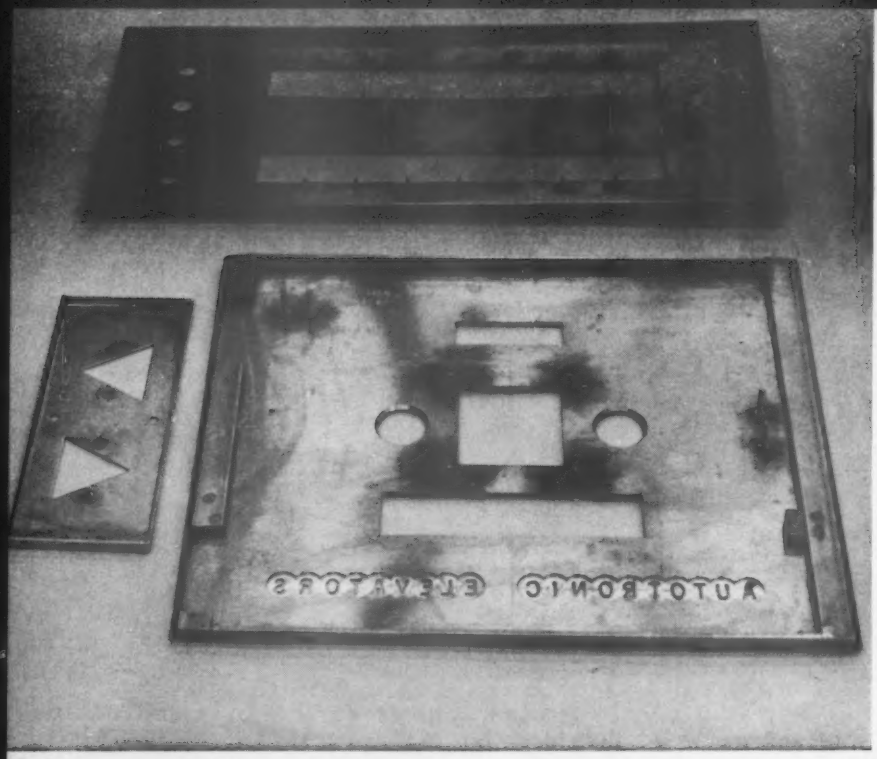


An especially important feature of stud welding is its ability to attach threaded studs to panels, without marring the polished or finished surface on the opposite side—a side which must be attractive and contain no protrusions. An example of this are these panels to be used in an automatic elevator. Note all the threaded studs.

material and the tensile strength of the stud employed.

Chart II presents some average ultimate test values for typical studs, as determined by a nationally-recognized testing laboratory. Welds tested were made on ¼ inch thick base materials, and values were determined at room temperature with standard laboratory equipment.

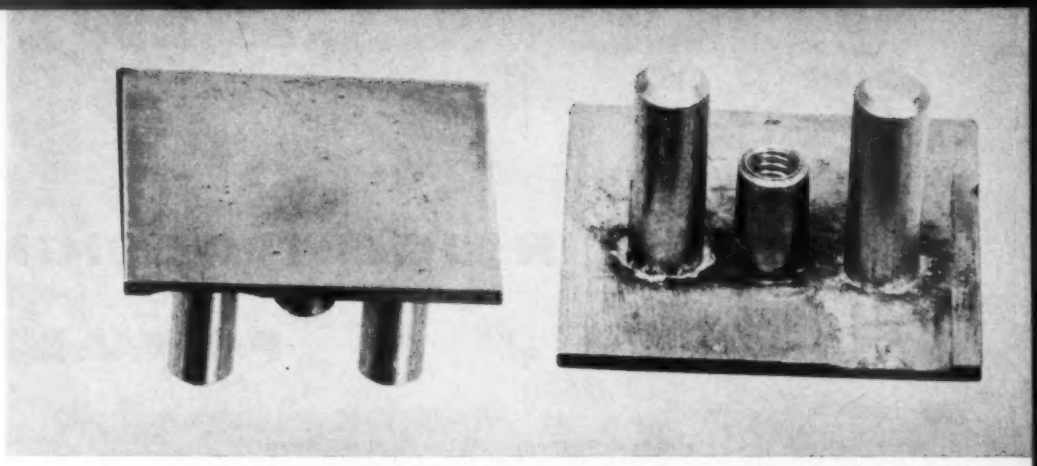
Stored energy percussive stud welding can provide the designer a means of achieving blemish- and protrusion-free surfaces, economically and accurately. The process permits a "clean-line" design that enhances both the appearance and sanitation conditions of products under consideration. The high strength of the welds produced makes the system readily adapted to light structural design and for specification in the fabrication of miniature operating mechanisms. •

Two ¼" diameter studs are welded to the opposite side of this .027" Zamac die casting.

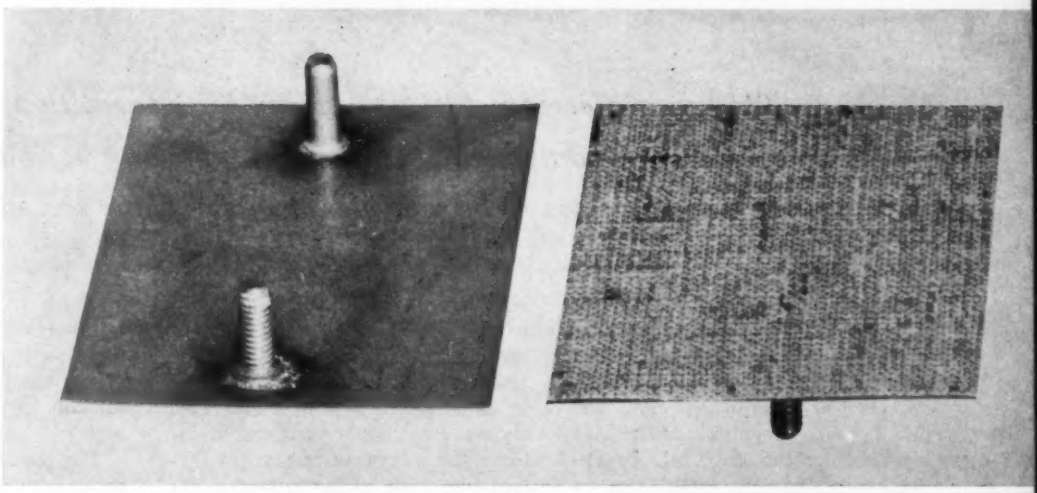
I. Material and Stud Selection Chart

Base Materials	Stud Materials			
	Low Carbon Steel	Stainless Steel	Silicon Bronze Brass	Aluminum
Mild & Low Carbon Steels 1003-1010-1018-1040	1008-1010-B-1112	304-305 & 416	65-35 70-30	
Structural Steel	1008-1010	304-305		
Stainless Steels-Type 202-302-304-305 & 430	1008-1010-B-1112	304-305 & 416	65-35 70-30	
Lead Free Brass	1008-1010-B-1112	304-305 & 416	65-35 70-30	
Electrolytic Copper & Rolled Copper (Lead-Free)	1008-1010-B-1112	304-305 & 416	65-35 70-30	
Aluminum -1100-3003-5005-5052-5357-6061 & 6063				1100 4043 6061

Here is an example of #8 studs applied to .032" thick brass.



Here is an example of #6 aluminum studs welded to .022" thick vinyl-clad aluminum.



II. Strength Characteristics of Completed Welds

Stud Material	Stud Size	Tension In Pounds	Torque in Lb.-In.	Shear in Pounds
Steel	¼-20	1300	55	1368
1010 or	#10-32	1000	29	1046
1008	#10-24	900	25	1000
Annealed	# 8-32	630	17	708
	# 6-32	450	9	482
Stainless	¼-20	3000	120	1590
Steel Type	#10-32	1950	60	1140
304 or 305	#10-24	1625	48	980
	# 8-32	1360	33	868
	# 6-32	950	16	800
Aluminum	¼-20	600	22	410
1100-H18	#10-32	390	12	259
	#10-24	340	10	265
	# 8-32	285	7	193
	# 6-32	180	3.5	131
Brass	¼-20	1680	60	1315
65-35	#10-32	1075	38	716
or	#10-24	900	27	700
70-35	# 8-32	750	18	575
	# 6-32	475	9	360

FACTORS IN JOINT DESIGN FOR ADHESIVE

by **Kenneth F. Charter,** Director, Plastics Research
and **Harry R. Butzloff,** Supervisor, Plastics Research
A. O. Smith Corporation, Milwaukee, Wisconsin

This article present factors leading to the selection of adhesives for joining metal components. Data represented by various graphs indicate factors to be considered in designing for adhesive bonding.

Parts to be bonded with adhesives must be designed properly to obtain the maximum strength properties. Factors dictating the joint design are dependent upon the direction and magnitude of the load and whether the stress will be applied continuously, short term or intermittently.

Most adhesives used for structural metal-to-metal bonding are relatively rigid but have some elastomeric properties. They are strongest in direct shear or tension and weakest in peel and cleavage. A large portion of the engineering data on metal to metal bonds have been obtained as shear strengths with plain lap joints, Fig. 1. This type of joint is easy to make and is quite common in manufactured items using adhesives since adhesive bonds exhibit high strengths when stressed in shear. Stress concentrations are produced in the bonded joint just as they would be in an unfilleted weld or braze. Two causes are mainly responsible for these stress concentrations: (1) Differential strain of the jointed members; (2) Bending of the joined members.

Referring to Fig. 2[1], each member bears the full load P just before the joint and transmits it gradually to the other through the adhesive. Thus the stress of the upper adherend will be highest at b and will gradually diminish until it is zero at c. However, in the lower member the stress will be greatest at c and diminish to zero at b. When the members obey the laws of elasticity, these members will develop strains proportional to the stresses. This results in higher stresses in the adhesive at each end of the overlap.

The members of the lap joint are necessarily offset by the amount of their thickness. This eccentric loading gives rise to a bending moment which will tend to pull the members apart. Under this moment the members will yield if the applied load is great enough. This is shown in Fig. 3. The tearing or peeling stresses are concentrated at the ends of the overlap and, combined with the effects of differential straining, considerably reduce the strength of lap joints. The Goland and Reissner theory[2] indicates that these concentrated tensile stresses at the

This article is based on a paper presented before the A.S.M.E. Design Engineering Conference in Detroit, May 22-25, 1961.

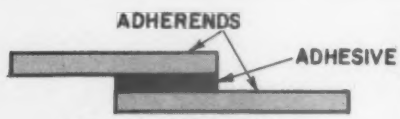


Fig. 1: A plain lap joint.

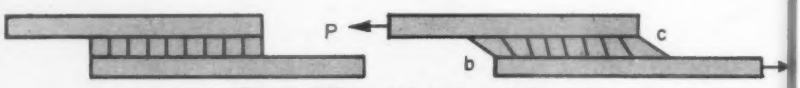


Fig. 2: Differential strain in a lap joint.

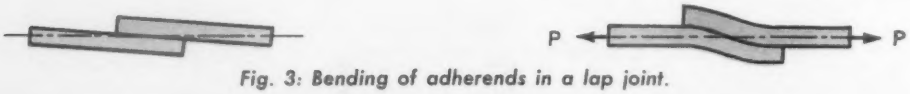


Fig. 3: Bending of adherends in a lap joint.

BONDING

edges of the overlap can reach 4.3 times the mean member stress with a rigid adhesive. The concentration of stresses at the ends of the overlap decreases somewhat as the flexibility of the adhesive increases but it is still the critical area in the bond. As a result, the observed failure loads on metals which can deform in this way are substantially below the true strength of the adhesive. The high proportion of the failure load carried in the edges of lap joints is illustrated by the fact that an adhesive showing an apparent bond strength of 3000 psi with a 1-in. overlap, will fail at about 2500 lb when the edges of the lap are bonded with a 1/4-in-wide band of adhesive on each edge. The center half of the lap, thus, contributes only about 1/6 of the total strength. This illustration indicates also that the apparent bond strength is not proportional to the length of overlap. DeBruyne[3] has shown this to be the case.

Fig. 4, adopted from DeBruyne's data, shows a representative curve of this phenomenon. Each adhesive will form a different curve but the general characteristics are similar.

The strength of a lap joint also depends on the thickness of metal and the yield strength of the metal, as shown in Fig. 5. The thickness of the metal and the overlap length have been combined into the term joint factor and related to failing stress by DeBruyne.

A smooth curve, Fig. 6, is obtained when joint factor is plotted against failing stress. The Martin Company working with aluminum alloys, has determined that the optimum overlap length is approximately twenty-five times the metal

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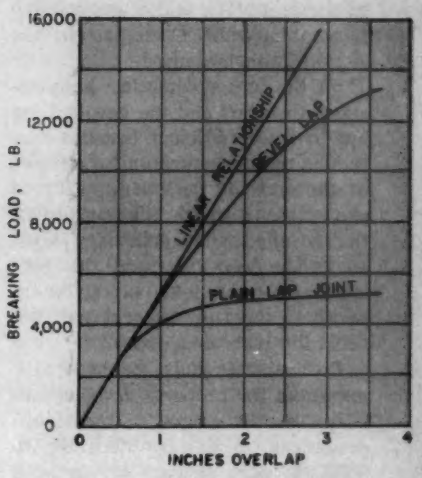

Fig. 4: Breaking loads in lap joints with varying amount of overlap.

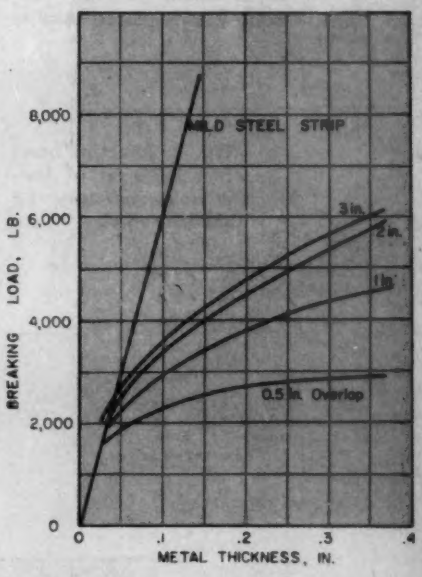

Fig. 5: Effect of thickness and overlap on the ability of bonded lap joints to carry a load.

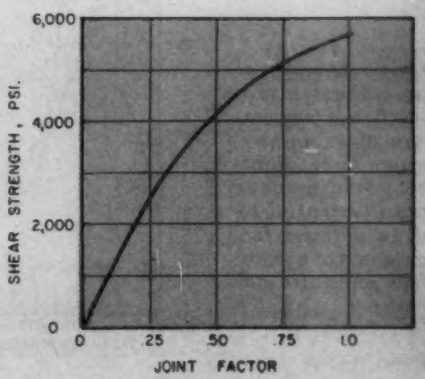

Fig. 6: Smooth curve obtained when joint factor is plotted against failing stress.

thickness for the particular adhesive they were working with, a phenol formaldehyde-vinyl butyral tape. DeBruyne points out that the strength of a lap shear joint is directly proportional to the width of the joint. The width and overlap factors have been verified in the A. O. Smith laboratory.

Of the variety of other joint designs, the scarf and the bevelled lap are the most efficient because they reduce the concentration of stresses at the ends of the overlap. Fig. 4 shows the strength relationship of the bevelled and plain lap joints. In production, however, the bevelled and scarf joints would be expensive and are therefore not generally recommended.

Peel stresses must be kept to a minimum for properly designed adhesive bonded joints. As mentioned previously, it is most desirable to bond the parts so that the adhesive is stressed in shear. In heavy sections, a bond that is placed in pure tension should be satisfactory. However, cleavage stresses usually result which reduce the strength of the joint.

STRENGTH PROPERTIES

Most strength data on adhesive bonds have been obtained with simple lap joints. Furthermore, most of the data has been obtained with aluminum or aluminum-alloy adherends because the great majority of structural adhesive applications to data have been in the aircraft industry. There is very little data on steel-to-steel bonds.

The effect of temperature on shear strength is shown in Fig. 7, based on the work of Eickner, Olson, and Blomquist[4]. They found, as did Kuenzi[5], that the thermosetting phenolic-synthetic rubber adhesives tend to show stronger bonds at high temperatures than do other adhesives. The work toward better high-temperature adhesives is receiving very much attention largely because of the demands of the aircraft and missile industry. More recently epoxy phenolics, high functionality epoxies and silanes have been considered. Forest Products Laboratory has been studying the effects of temperatures from —100° to +1000° F on the strength properties of seven commercial metal bonding adhesives. Lap shear, long-time load, peel and fatigue tests are involved. Tensile shear strengths of 2300 psi at 350° F over 1100 psi at 500° F have been reported.

The strength of a lap shear joint is also dependent upon the thickness of the glue line. Koehn[6] has shown that an optimum glue line thickness exists. The optimum thickness appears to be about 4 to 6 mils but varies with adhesive used, Figs. 8 and 9[6]. More recent experience indicates epoxy adhesives are not as critical in glueline thickness as those reported by Koehn.

The fatigue strength of lap shear joints is shown in Fig. 10[7]. The load was cycled between the tensile shear loads indicated on the graph and 10 per cent of that load. It was found that the fatigue strengths at —65° to —70° F are very nearly equal to those at room temperature. Also, most of the failures at the low stress levels were in the metal rather than in the adhesive bond. Unpublished work in our laboratory at A. O. Smith Corporation has shown that the fatigue strength at 4 x 10^6

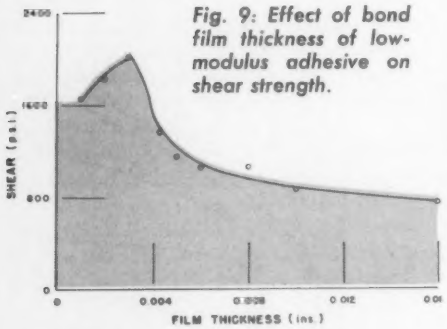

Fig. 9: Effect of bond film thickness of low-modulus adhesive on shear strength.

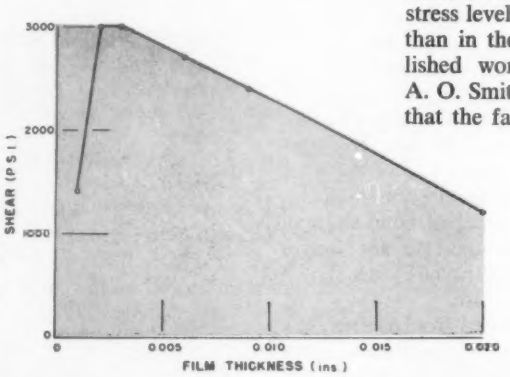

Fig. 8: Effect of bond film thickness of a high-modulus adhesive on shear strength.

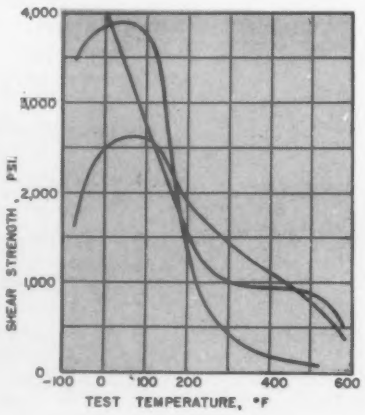

Fig. 7: Strength of an adhesive is a function of temperature of its environment. Three different performances are illustrated by three different formulations of a modified phenolic adhesive.

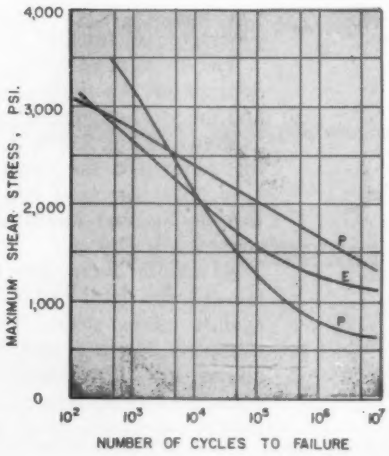

Fig. 10: Fatigue failure of two modified phenolic adhesives, P, and one epoxy adhesive, E.

cycles is 35-60% of the ultimate tensile shear strength and is dependent upon the test frequency.

The effect of long-term loads or stresses on lap shear joints is shown in Figs. 11 and 12, adapted from Eichner's work[7]. Even at 180° F some adhesive bonded joints are able to withstand high stresses for long periods of time.

Work in our laboratory on steel adherends has shown stress-rupture limits of 30-45% of ultimate strength with rubber-modified phenolic adhesives and up to 75% with an epoxy adhesive.

The Nation all Luchtvaart Laboratorium, Amsterdam[8], found that Redux-bonded joints will withstand at least 75% of the short-time breaking bond at room temperature for long periods. Their tests were conducted for times up to 6 months.

The effect of impact on adhesive bonded joints has been determined on lap-shear specimens in our laboratory using a falling-ball test. Results obtained by this test method are shown in Fig. 13. It is felt that this test is a good method of comparing the impact resistance of various adhesives.

It has been mentioned that structural adhesive joints should be designed to minimize the effect of peel and cleavage. Peel tests are usually conducted with one flexible member bonded to a rigid member and are tested by peeling the flexible member at an angle of 90° or 180°. Recently, ASTM prepared a new test method for peel, based on a climbing drum. For structural adhesives the peel strengths are in the range of 10-25 lb per in. of bond width. The high-modulus, rigid adhesives such as unmodified epoxies and phenolics have lower peel strengths than do lower modulus adhesives such as rubber-modified phenolics. Koehn[6] has shown that peel strengths increase as the bond thickness increases. DeBruyne[8] has stated that the peel test is preferred to lap-shear tests as a production control test because it is much more sensitive to changes in adhesive, surface preparation, etc.

Adhesive bond strengths when tested in pure tension are usually considerably stronger than when tested in tensile-shear. The introduction of cleavage, however, can greatly influence the apparent tensile strengths. Koehn[6] points out that an adhesive that will demonstrate a tensile strength of 6000 psi with one type of tensile specimen will fail at about 2700 psi with another type of tensile specimen in which cleavage is apparently introduced. Also, the Naval Ordnance Laboratory[9] has shown the variation in apparent tensile strengths that can be obtained with differently designed specimens (see Table I, next page).

Wittman[10] has conducted tests relating tensile-shear strength at room temperature to the rate of loading of the specimens. His results, presented in Fig. 14, indicate that for the more rigid adhesives, phenolic-vinyl butyral and epoxy, the tensile-shear strength remains fairly constant as the rates of loading increases. The shear strength of the less rigid adhesives, phenolic-synthetic rubber, increase markedly as the loading rate increases. A round-robin test program conducted by ASTM Committee D-14 on Adhesives found that steel and

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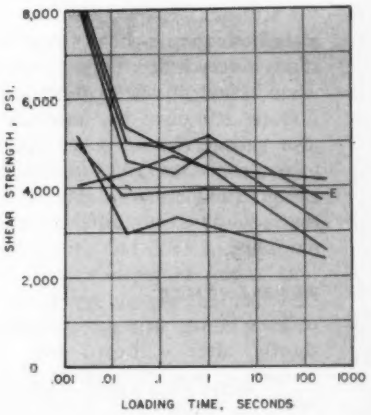
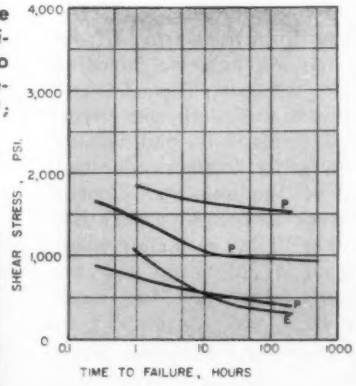


Fig. 14: Effect of rate of loading on shear strengths of aluminum to aluminum bonds at room temperature. All adhesives were modified phenolics, except one epoxy.

Fig. 12: Stress rupture of aluminum to aluminum bonds at 178 to 182 F—modified phenolic adhesives, P; epoxy adhesive, E.



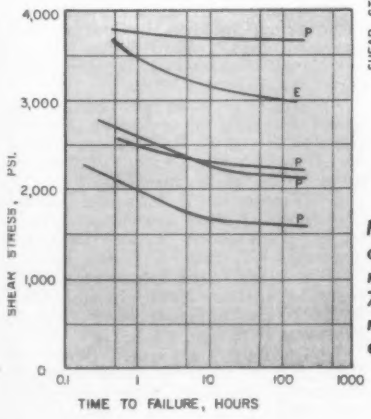


Fig. 11: Stress rupture of aluminum to aluminum bonds at 72 to 76 F—modified phenolic adhesives, P; epoxy adhesive, E.

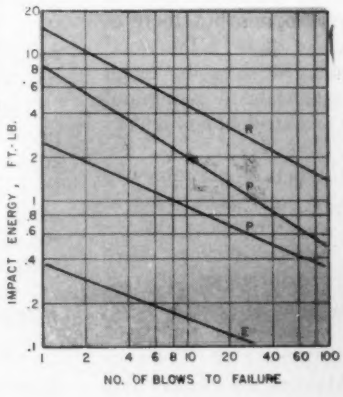


Fig. 13: Impact resistance of lap joints to a dropping ball; impact energy level vs. blows to visible failure. Three energy levels were used for each adhesive—R, a modified rubber; P, modified phenolics; E, an epoxy resin.

Table I. Tensile Strength Versus Geometry

DESIGN	A	B	C	D
Bonded area, square inches	1.0	0.601	1.0	0.196
Grip flange opening, inches	1.552	1.140	1.140	—
Thickness of grip flange, inches	0.187	0.250	0.250	—
Tensile strength, psi	3540	5740	7870	8710

aluminum tensile-shear specimens showed very little change in strength when tested at rates of stress from 600 to 2000 psi per min. It was also shown that it is not possible to express one rate of stress as being equivalent to a rate of strain for adhesives of different elastic modulus.

PERMANENCE

The bond strength determined shortly after a bond has been formed is not an indication as to what the strength will be after aging or exposure to various environments.

There is not very much information available on the permanence of metal to metal bonds but there is an abundance of data on the wood to wood bonds. Most of the metal to metal data pertains to aluminum. Data on steel to steel bonds is very meager.

Forest Products Laboratory[11] started outdoor weathering tests in 1953 in six locations from Alaska to Panama. Some adhesives have shown good performance after 3 years' exposure in Florida and the Canal Zone while other adhesives deteriorate. Exposure in Madison, Wis., New Mexico, and Fairbanks, Alaska, was generally less severe than the Florida and Canal Zone exposures. Forest Products Laboratory is continuing this work[12]. Painted steel to steel bonded specimens have been exposed on our plant roof in Milwaukee for over 5 years with very little change in strength. In some cases an increase in strength was found.

Military Specification MIL-A-5090B requires adhesive bonds to withstand salt-spray exposure and immersion in water, ethylene glycol, anti-icing fluids, oils, and various fuels. In general, many adhesives meet these requirements. Unpublished work in our laboratory has shown that 72 hrs in boiling water is a good accelerated test for comparing adhesives for water resistance.

The durability of glued birch plywood to clad aluminum and cold-rolled steel joints was studied by Eickner[13]. Specimens were subjected to twelve exposure conditions including outdoor weathering for periods of times up to one year. •

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(4)"Effect of Temperature from —70° F to +600° F on Strength of Adhesive-Bonded Lap Shear Specimens of Clad 245-T3 Aluminum Alloy," by H. W. Eickner, W. Z. Olson, R. F. Blomquist, NACA Technical Note 2717, June 1952.

(5)"Strength of Aluminum Lap Joints at Elevated Temperatures," by E. W. Kuenzi, Forest Products Laboratory Report 1808, December, 1949.

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(12)"Environmental Exposure of Adhesive Bonded Metal Lap Joints," WADC Technical Report 59-164, Part I, February 1960.

(13)"Durability of Glued Wood to Metal Joints," by H. W. Eickner, Forest Products Laboratory Report No. 1570, June 1947.

Structural characteristics of fasteners for honeycomb

by **Jack Cherne,** Assistant to the President, Shur-Lok Corporation

A report on the results of research conducted to develop a spectrum of fastener strengths as affected by aluminum sandwich panel construction. Potted-in fasteners were used in the tests.

Little information has been published to date on the tensile strength of honeycomb fasteners with variations in sandwich characteristics. The research performed for this article was intended to develop enough data to present a spectrum of fastener strengths as affected by sandwich panel construction. In order to accomplish this, three variables were selected: skin thickness, core density, and over-all sandwich thickness. The core material selected was aluminum honeycomb, the skins were 2024 ST aluminum, and the fasteners used were our SL78 potted-in inserts. The results of the tests are presented as a plot of ultimate strength versus panel thickness for various combinations of skin and core densities.

In the years that potted-in fasteners for honeycomb sandwich material have been used the design strengths of the particular assembly have been based on specific tests of the configuration involved. However, it is evident that the usage of these structural assemblies are sufficiently similar to each other to allow for the development of a general set of test data encompassing the majority of variations in construction.

Most honeycomb sandwich panels (both those used for primary structure and those used for a secondary nature) will fall into the over-all thickness range of from 0.25 to 0.75 inch. Likewise, the skin thickness range of 0.010 to 0.040 inch will cover the majority of usage. A core density range of 2.3 to 6.0 pounds per cubic foot was selected.

In order to keep the number of test samples to a minimum, three specific points of each variable were selected. Skins of 0.010, 0.020, and 0.040 inch 2024 ST aluminum were used. The three core densities were 2.3, 4.3, and 6.0 pounds per cubic foot. Panels using these six different types of materials were fabricated in 0.25, 0.50, and 0.75 inch thicknesses. The resulting 27 sets of test specimens were then assembled with potted-in inserts and tested in tension.

SPECIMEN PREPARATION

The honeycomb core material selected was Hexcel aluminum with ¼ inch cell size. The core foil was

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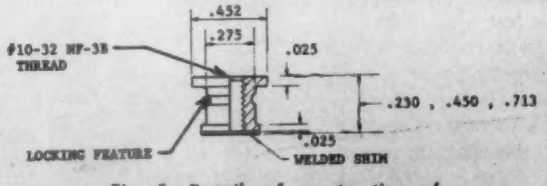


Fig. 1. Details of construction of potted-insert used in this study.

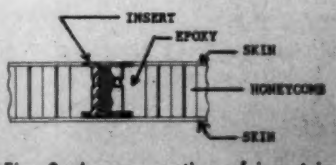


Fig. 2. A cross-section of insert in honeycomb sandwich-type panel.

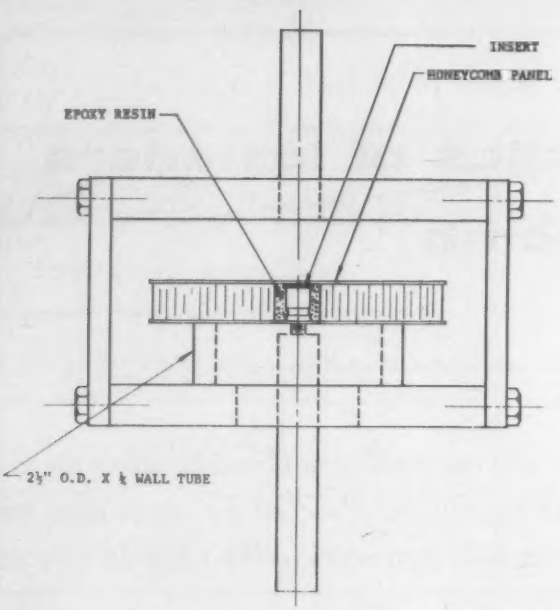


Fig. 3. The honeycomb specimens were tested in this standard fixture.

0.001, 0.002, and 0.003 inch thick, yielding core densities of 2.3, 4.3, and 6.0 pounds per cubic feet.

In order to keep the amount of different core materials to a minimum, the core was obtained sliced in 0.25, 0.50, and 0.75 inch thick slices. When fabricated with the various skin thicknesses, the over-all thickness varied from each other due to difference in skin thickness.

The 2024 ST aluminum skins in 0.010, 0.020, and 0.040 inch thicknesses were assembled to the core materials using an adhesive with fiberglas tape. The skins and core were fabricated in large panels measuring approximately 3 feet square. The individual test specimens were then cut out of these large panels by band sawing. Care was exercised to prevent delamination of the skin to core bond. The individual tension test specimens measure 3 inches square.

Our series of potted-in inserts were installed in the test specimens by first end-milling a hole of proper diameter through one skin and core to a depth equal to the over-all length of the fastener used. An end-mill was used in order to prevent damage which is possible with the thin skins used. This also permits obtaining a flat-bottomed hole close to the bottom skin without any possibility of damage to the undrilled skin. No attempt was made to remove any particles of the aluminum core material from the hole.

The catalyst and the basic epoxy used were mixed in a ratio of 10 per cent by weight as recommended by Shell Chemical Company. After the epoxy was thoroughly mixed, it was placed in a polyethylene syringe and inserted in the cavity of the test specimen in sufficient quantity to insure complete filling of the cavity after insertion of the insert. Care had to be exerted in this procedure to prevent the entrapment of large air bubbles. In order to maintain clean test specimens, the test specimen was covered with a layer of transparent tape so that any excess epoxy could be removed from the specimen with ease. Tape was also applied to the insert to prevent the possibility of epoxy getting into the threaded hole. The test specimens were allowed to harden at least 48 hours before load was applied to them.

Details of construction of the insert used are shown in Figure 1. A typical cross section of the potted-in insert in the sandwich panel is shown in Figure 2. The fastener lengths are designed so as to fit flush on one side of the sandwich panel and allow room for variation in skin thicknesses on the opposite end and still occupy the greatest depth in the sandwich as possible.

TEST PROCEDURES

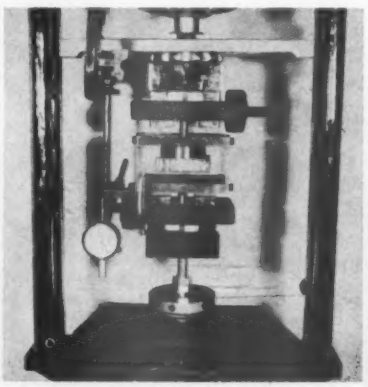
The test specimens were tested in tension with the specimen in a standardized test fixture as shown in Figure 3. For the majority of specimens the capacity of the dynamometer on the test machine was 1,000 pounds with dial divisions of five-pound increments. The few specimens which exceeded the 1,000 pound capacity were tested using a dynamometer with a 2,500 pound capacity with 25-pound increments. The honeycomb test specimen is supported in the fixture on a steel tube of 2½ inches outside diameter and ¼ inch wall thickness. The load was applied to the insert by means of a hardened steel screw. A photograph of the test setup in the tension test machine is shown in Figure 4.

TEST RESULTS

We kept a tabulation* of the ultimate load capacities of 98 specimens tested. Originally it was planned to use only two lengths of insert, ¼ inch inserts for the ¼ inch panels and ½ inch inserts for both the ½ and ¾ inch panels. It was

*Individual copies of this tabulation are available upon written request.—Ed.

Fig. 4. Test set-up with honeycomb specimen in tension test machine.



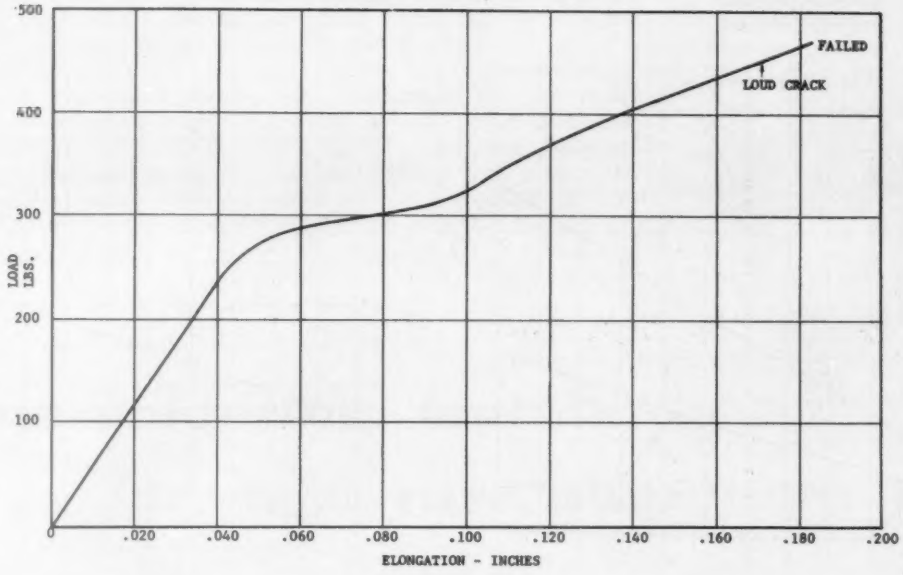


Fig. 7. Typical load-elongation curve for tensile test samples.

assumed that the insert lengths would not materially affect the strength of the combination. Preliminary results show that there were two limits to the strength of the assembly. First premature failures were observed in the ¾ inch panels as a result of the lower flange of the insert failing in shear. In the ¾ inch specimens where the skin thickness and core were of lesser strength, the specimens failed in tension through the epoxy immediately under the insert. This was due in part to the narrow band of epoxy around the insert which was incapable of transferring the load to the full depth of the core. This could be alleviated by undercutting the core after the hole has been drilled in the panel, allowing greater diameter of epoxy around the insert. However, in order to keep the cost of assembly down, it was decided to continue the tests on these heavier panels using a full length insert in the ¾ inch panels. This full length insert was designed to include a thicker bottom flange capable of reacting the full tensile load applied.

Figure 5 is a photograph of a typical tension test failure. Mode of failure usually begins with a tension failure of the epoxy between the lower skin and the insert. After this occurs the load is reacted by both shear in the core and bending in the upper skin. Due to the thin core material the shear loads applied to the core produced diagonal tension in the walls of the aluminum honeycomb. The next mode of failure

Fig. 5. A typical tension test failure.

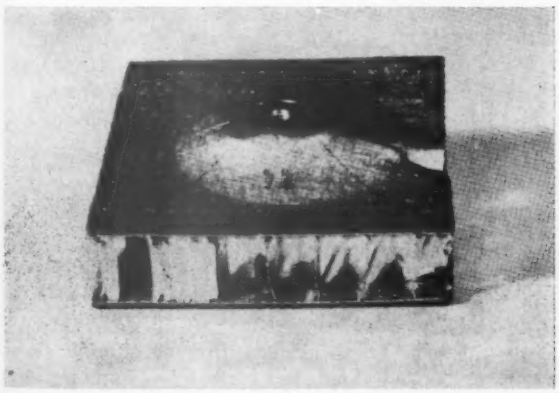
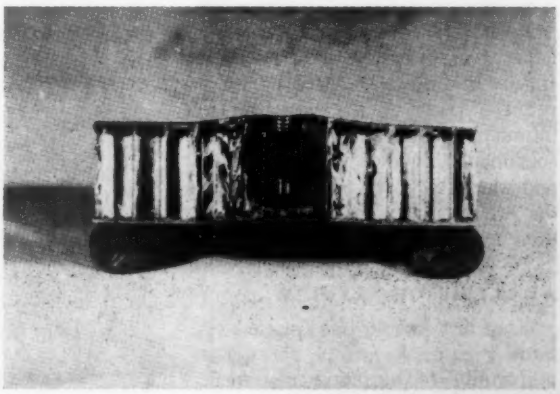


Fig. 6. A cross-section of typical failure.



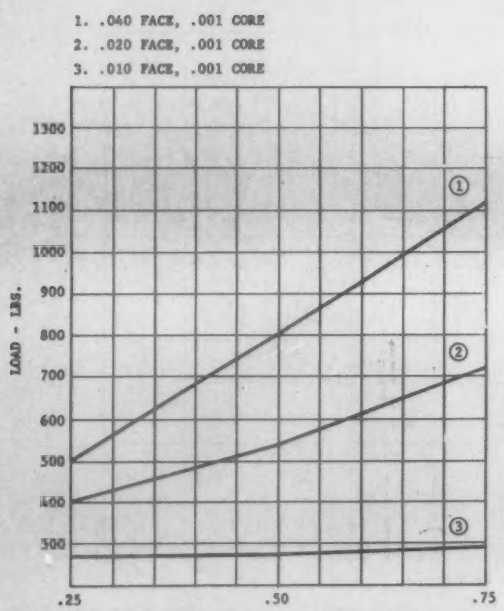


Fig. 8. Test results for .001 core.

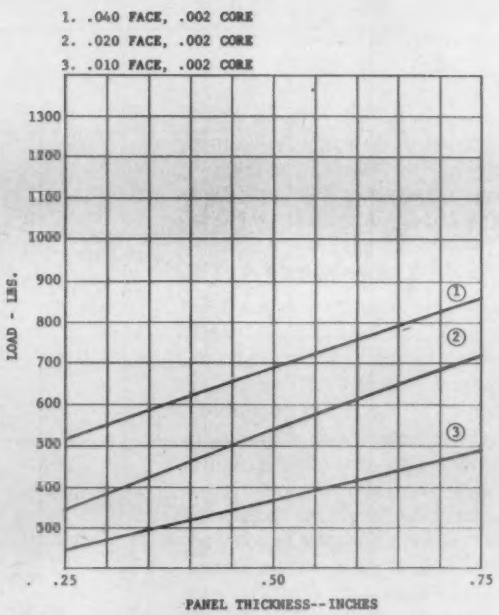


Fig. 9. Test results for .002 core.

then is a diagonal tension failure of the walls of the honeycomb. This is accompanied by large deflections of the upper skin changing the loading of the skin from bending to a catenary type of tension. Final failure is a tension failure of the upper skin.

A photograph of a cross section of a failed specimen is shown in Figure 6. Visible in this photograph is the tension failure in the epoxy between the bottom of the insert and the bottom of the panel, the diagonal tension wrinkles (shear buckles) in the honeycomb cells, and a tension failure in the honeycomb.

Figure 7 is a plot of a typical load-elongation curve for these test samples. The changes in slope of the curve give evidence of the several modes of failure. Figures 8 and 9 are the plots of the variation in ultimate strength with variations in specimen thickness, core density, and skin thickness. The trends of the test results are very evident in these curves.

ANALYSIS OF RESULTS

The test results as plotted in both Figures 8 and 9 show fair uniformity of variation of tensile strength versus honeycomb panel attributes.

An analysis of the shear strength of the flange of the basic insert follows. The diameter of the body of the insert is 0.277 inch. The thickness of the flange is 0.027 inch. Allowing for the loss of shear area adjacent to the anti-rotational flats on the flange, the shear area is calculated to be 0.018 square inches. Assuming the ultimate shear stress allowable for the insert material to be 40,000 psi (material of insert is 1137 steel), the ultimate shear strength of the insert then becomes 725 pounds. This value agrees with the test results since shear failures of the flange occurred at between 800 and 850 pounds.

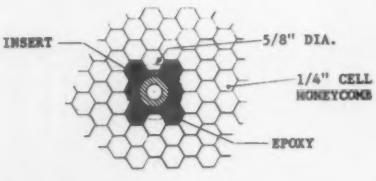


Fig. 10. A lateral cross-section through insert. Area around the insert will be filled with epoxy.

SHEAR STRENGTH

Another important analysis to consider is the shear strength of the core around the insert. Figure 10 shows a lateral cross section through the insert. Shown around the insert is the area that will be filled with epoxy. Using ¼ inch cells as we have in this test program, the average diameter of the epoxy where it joins the honeycomb core is estimated to be ⅝ inch diameter. Since the honeycomb core has different shear strengths in the length and width directions, calculations of the shear strength in this particular application are based on an average of these two shear strength values. The average shear strengths for the three cores used are: for the 2.3 pound density core the average shear strength is 77.5 psi, for the 4.3 pound density core the average shear strength is 207.5 psi, and for the 6.0 pound density core the average shear strength is 350 psi.

Calculation of the ultimate shear load strength of the core around the

insert for the various materials used results in values which vary from a minimum of 38.2 pounds for the lightest core in a ¼ inch depth to a maximum of 517 pounds for the heaviest core in the ¾ inch depth. These values which are much lower than the ultimate loads show that the load is reacted by a combination of shear in the core, tension between the bottom of the insert and the bottom skin, and tension in the top skin.

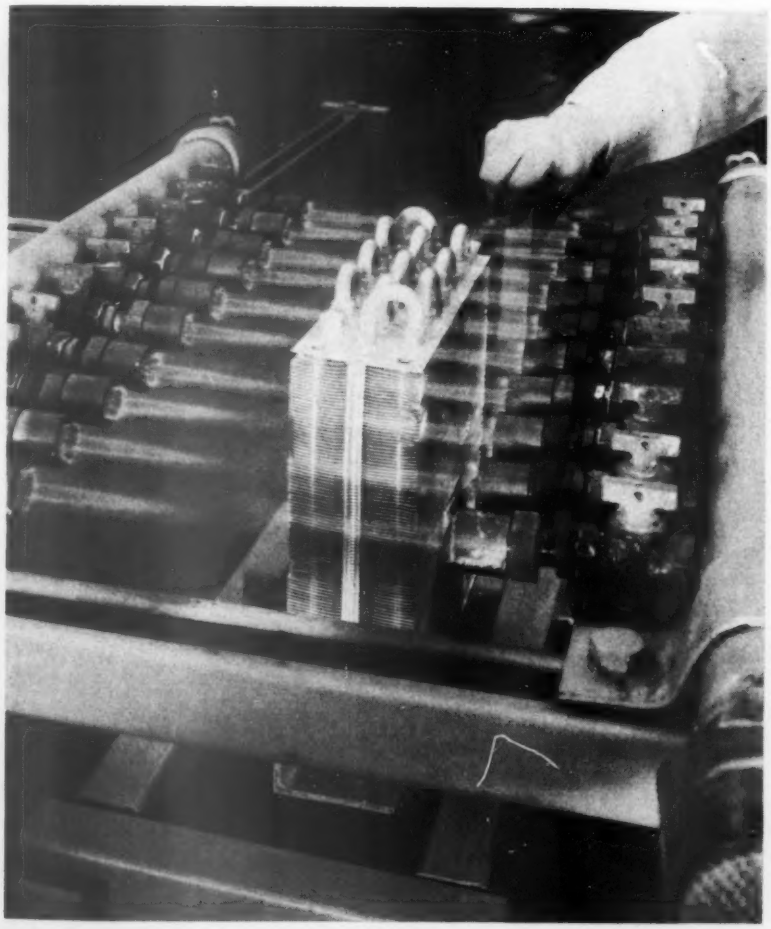
It would be possible to increase the strength of individual fasteners in these honeycomb materials by increasing the effective diameter of the bond between the epoxy and the core. This can be done by undercutting the core around the hole in the skin thus permitting the epoxy to flow to many more cells in the honeycomb or by using different configurations of inserts. One of these would be the SL1 Series of Shur-Lok inserts which are one-piece units of larger diameter. Some data on the strength of this type of fastener exists for specific applications.

ACKNOWLEDGMENT

Mechanical properties of Hexcel aluminum honeycomb were obtained from "Honeycomb Sandwich Design Data and Test Methods" published in 1959 by Hexcel Products Inc.

This article is based on a paper presented before the A.S.M.E. Aviation Conference in Los Angeles, March 12-15, 1961. •

Flame-soldering technique for multi-row aluminum coils



This demonstration of flame soldering multi-row aluminum condenser coils was viewed by engineers from the leading air conditioner manufacturers.

The use of the flame-soldering technique for joining the return bends of aluminum tube in multi-row coils was demonstrated recently by Aluminum Company of America and Selas Corporation of America at the latter's research laboratories in Dresher, Pennsylvania.

The technique should help pave the way for broader use of aluminum in air conditioning equipment.

The test was viewed by engineering representatives of leading firms in the air conditioner industry. This industry has made extensive use of aluminum tube in single- and double-row condenser and evaporator coils of production model air conditioners, but only limited use of aluminum tube in larger coils. This has been due to problems resulting from the intense heat generated when soldering joints in multi-row coils.

The test results showed that the use of aluminum tube for multi-row condenser coils is feasible, and that aluminum can be joined rapidly and efficiently by the zinc soldering technique.

An automatic flame-soldering machine was used in the simulated production operation. This unit is a laboratory adaptation of production equipment developed by Selas. The flux and solder used in the zinc-soldering process were developed by Alcoa. •

With runs on specific hi-fi units from 100 to 200 units, Altec-Lansing developed some interesting short-run assembly techniques reviewed here.

ASSEMBLING SHORT-RUN HI-FI

Just ten years ago, high fidelity was a laboratory infant; today, it's an industrial giant. Few segments of American industry have mushroomed to prominence so quickly. Now, inspired by the advent of stereophonic sound, this newborn giant is gathering additional stature.

The high fidelity industry did not follow the usual pattern of industrial development. No huge corporations were formed to sponsor its growth. Capital was often limited and hard to come by. There was no drastic or material need for its product. Its market had to be created and cultivated in the cultural needs of people living in a materialistic world. Fortunately, this turned out to be a very fertile field. To the surprise of many, and to "big capital" in particular, it turned out that the American people were just as susceptible to a good Beethoven recording as they

Here tube sockets are being riveted to chassis for an Altec Lansing hi-fi unit. This fastening technique assures the metal-to-metal bond required between the chassis and the tube socket ground lug.

by **John S. Taylor**
Assistant Plant Manager
Altec Lansing Corporation
Anaheim, California

EQUIPMENT

were to scented soap, soft tissues, and succulent cigarettes.

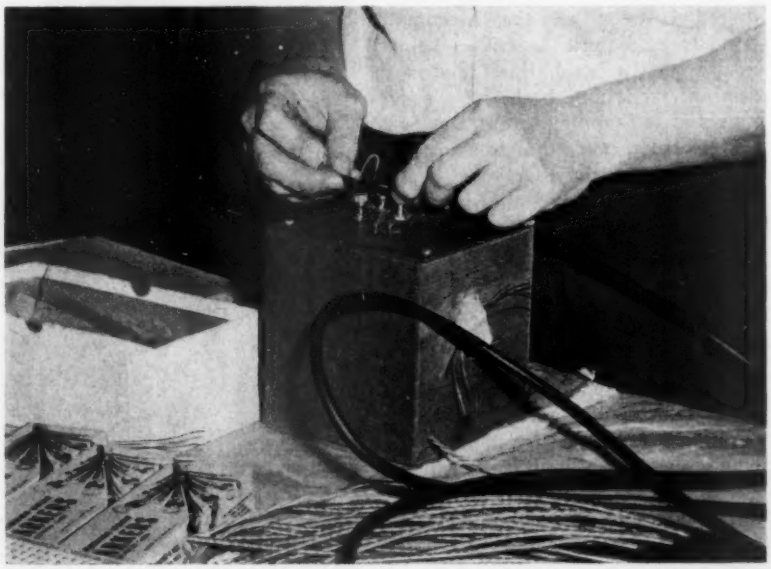
As a result of this early uncertainty concerning profits, the birth of the high fidelity industry can be traced to dozens of small shops, service organizations and laboratories across the nation where, because of a personal interest in the project, product quality was of paramount importance. Altec Lansing was one such small shop and service organization. Employing but a few people, Altec Lansing manufactured and installed theater sound systems. With the advent of high fidelity, and long before the average person had heard the words let alone the results, extensive research and limited production was begun on various high fidelity components. Today, with more than 400 people on its payroll and occupying a new plant site, our company is producing a variety of sound equipment, including tuners, amplifiers, speakers, and associated equipment.

A quick trip through the plant can provide an object lesson in how a modest sized manufacturer can attain national status in the production of precision electronic equipment. Extended production and assembly lines, automated equipment, computer-operated processes, and highly specialized tooling are conspicuously absent. On the other hand, and almost unnoticed until the individual efforts are noted and fitted together like the pieces of a jig-saw puzzle to establish a definite pattern, the provisions for product quality control permeate every operation. These apply from the time a wire is stripped of insulation so it can be soldered, to the ultimate product as it receives a check-out

continued

Multi-lead circuit cables are pre-assembled on this layout board. The wire ends are held in designated positions by simple coil springs.

Insulation is stripped from shielded cable with this device. Small transformer in box feeds ten amperes at two volts through short "hot wire" which melts through insulation as cable is rotated against the wire.



test in a screenroom insulated from outside interference. In many cases, this infusion of quality control techniques is accomplished in a manner to actually simplify various production and assembly operations.

The production-assembly pattern for electronic components at Altec Lansing hues closely to the conventional. Parts from the fabrication departments, various sub-assembly departments, and purchased parts from the stockroom are brought together in an assembly line loading area. Here the product chassis is fixtured or tooled for handling along the assembly line. The various parts which will be added as the assembly progresses are then delivered to their respective assembly stations along the line. The average production run on a specific product may vary from 100 to 200 units.

But it is the small and almost unnoticed acts and techniques along the line which add up to comprehensive product quality control and at the same time contribute assembly speed. For instance, when the blanked, punched and formed chassis components arrive from the machine shop, the first assembly operation is the addition of tube sockets, transformers and capacitor boxes, and other sheet metal accessories. Whenever possible, one of three types of fasteners are employed in these mechanical assembly operations—"speed nuts," self-tapping screws, or rivets.

From the product quality standpoint, a good electrical bond is required between all chassis components, and these fastenings help assure such a bond. From the assembly standpoint, both the speed nuts and self-tapping screws can be driven from one surface using a powered screwdriver. Only two rivet sizes are used in automatic riveting, with an automatic riveter set up for each size. Thus two machines can accomplish all the work without lost setup or changeover time from one rivet size to another.

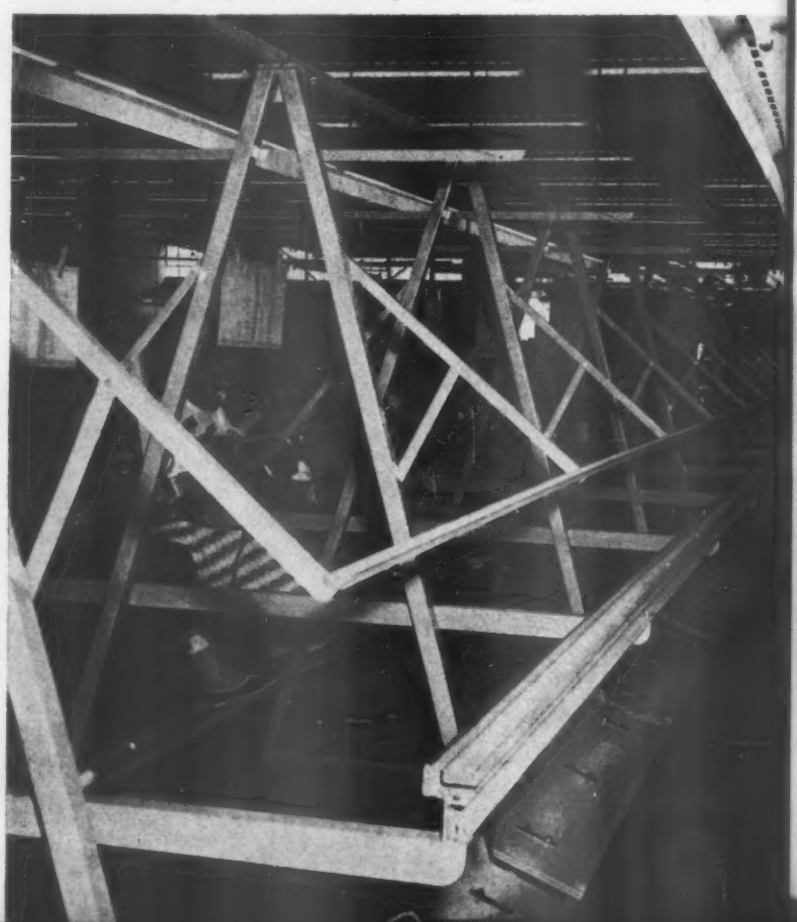
In one sub-assembly department, wires are prepared for installation on the main assembly line. All the wires are pre-cut to the proper length, thus eliminating overly long leads which are usually deleterious to electronic circuit operation. An automatic wire cutter with a pre-set wire length stop is used for this operation. As the wire is cut, the insulation is automatically "stripped back" a short distance from the end to allow bare wire for soldering. Then, to assure the best possible soldered joint, the stripped ends of the wires are pretinned by dipping them in a small pot of molten solder. Some wires are already tinned and do not require this dipping operation.

The various pre-cut and stripped wires are color-coded according to the circuits in which they will be used. Thus filament circuit wires are one color, B-plus circuit wires another, and so on. When two wires must be twisted together before installation to minimize circuit interference, this operation is accomplished on a small twisting machine in the wire preparation department. The prepared wires are then bundled together and delivered to the appropriate main assembly line station. Anyone who has ever wired an electronic circuit will note the amount of time saved by not having to cut, strip and tin each wire before it is installed. Anyone who has ever repaired an electronic circuit will note the convenience of wire color-coding so that each circuit can be traced by sight alone.

Shielded cables are also cut to length and prepared for installation in this wire preparation department. Shielded cables contain an inner conductor, a layer of insulation, and outer conductor of braided wire around this insulation, then an exterior layer of insulation over this braided conductor. To prepare the cables for installation, the outer layer of insulation must be removed for a distance back from the end, the braided wire peeled back, then the inner insulation removed for a shorter distance from the inner conductor.

Right: Over-all view of adjustable A-frame structure that runs the length of each assembly line. Simple wood or metal fixture strips attached to each chassis guide the chassis along the adjustable slides.

Below: Opposite side of A-frame structure shown at right. This side will be tooled and ready to go when assembly work on opposite side is completed.



Formerly, a sharp knife or razor blade was used to slit around the insulating sleeve so that it could be removed. But in doing so, there was always the danger of cutting through the fine braided wires just beneath the insulation layer. This could alter the electrical characteristics of cable and affect product quality accordingly. To avoid this danger, a company-designed device is used to melt through rather than cut through the insulation layer; this avoids the danger of cutting the underlying wires. This device is simply a small transformer, connected to line current, which delivers 10 amperes at 2 volts through a short length of "hot" wire. To cut through the insulation around the cable, the cable is merely held against the hot wire and rotated.

Physically, the main assembly lines at Altec Lansing are tooled with simple A-frame structures which can be easily adjusted to hold different products at different times as they are slid along from one assembly station to the next. Both sides of the A-frame are accessible, and two assembly lines could operate at one time on each structure, but this was not the theory that prompted this "two faced" installation.

It has already been pointed out that Altec Lansing produces many different electronic components, each in relatively short production runs of from 100 to 200 units each. Naturally, these short production runs require frequent assembly line changeovers. If only a single line were being used, and when a changeover was necessary, the first operator on the line would have to wait until the last product was assembled before the changeover could be made and the line adjusted and supplied for the next product.

With the "two faced" line, one side of the line can be adjusted and supplied while the other is involved in assembly operations. Thus when the first operator on the line finishes his last operation on one line, he moves immediately to the other side and starts on the next product. Then as each operator along the line finishes his last operation, he moves into the opposite line. Thus when the last operation is being performed on one line, the new line is in full operation except for the last station. This arrangement results in considerable time-saving during line changeover.

Once again, work along the main assembly line is divided into categories and sequences which assure ultimate product quality. A good soldered joint in an electronic circuit demands excellent metal-to-metal contact as well as careful application of solder. There is always the danger that a careless operator will merely "hold" the joint interfaces together, then apply the solder. When this happens, the solder is bound to flow between the interfaces and no metal-to-metal contact will be made. Such crude joints are difficult to detect.

Along the Altec Lansing lines, the first operator is charged with mounting the component or part (a resistor, a capacitor, a lead, etc.) and crimping the joint tightly to secure a good metal-to-metal contact. The

continued

second operator is charged with the responsibility of making sure that metal-to-metal contact exists before he solders the joint. No one operator makes, crimps, and solders a joint singlehandedly. This division of work not only speeds assembly, but the double responsibility implied results in high quality soldered joints.

Each operator along the line performs several assembly operations. The operations to be performed at any one station are color-coded on an assembly drawing mounted just in front of the operator. The color-coding on the drawing corresponds with the color of the wire component to be mounted. Resistors, capacitors, etc., are called out in their true values on the drawing and are made available in quantity lots at each assembly station.

Each component is inspected for workmanship only at the end of each assembly line. This inspector has nothing to do with the correctness of the wiring layout nor parts placement. His sole purpose is to determine that the workmanship, as it exists, is of utmost quality. Rejects at this point pass to a rework bench and are never re-inserted in the main assembly line.

Immediately after assembly, all components are given what might be called a rough test to determine whether or not they are in working condition. This test immediately rejects any components which have been incorrectly wired, or which contain defective purchased parts such as an open transformer or resistor or shorted capacitor. Some components are also "burned in" during this test, or operated for a specified period of time before they are passed on for final testing, alignment, and checkout.

Final tests, of course, vary with the product and are usually conducted in accordance with established standards for that product. After it has been ascertained that an amplifier is in working condition, critical tests will determine its hum level, its frequency response, its transient response, its audio power output, etc. Radio tuners are critically aligned in a shielded "screenroom" to assure ultimate performance, maximum noise rejection, and maximum sensitivity. Pre-amplifiers, microphones, and commercial sound installation units receive similar applicable testing.

As intimated throughout this article, the emphasis at Altec Lansing is on quality rather than quantity. However, by extremely careful planning, and by infusing every job in production and assembly with definite quality requirements where they can be most easily and simply met, utmost quality standards have been maintained in the face of increasing production schedules. •

Close-up of work station on main assembly line. Operator is mounting and crimping components in place to assure metal-to-metal contact. Joints will be soldered at next station. Color-coded layout indicates the operations to be performed at this work station.

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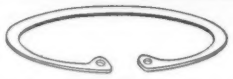

INTERNAL TYPE
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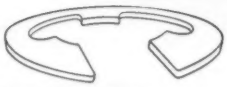

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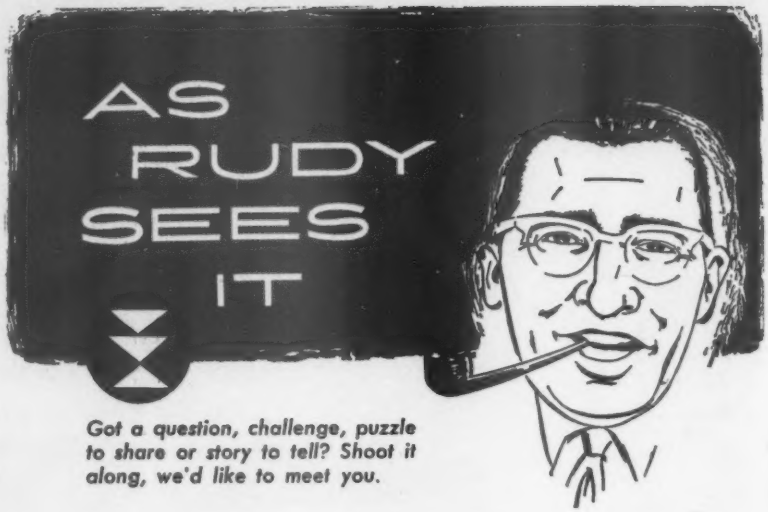


Got a question, challenge, puzzle to share or story to tell? Shoot it along, we'd like to meet you.

HUMAN FUDGE FACTORS

Not all goofs in design and development of a product are the results of machines. Dr. Finagle has drawn up some laws, which to some extent represent man's reaction to Nature, and even more aptly, man's reaction to man:

Law No. 1: Information necessitating a change of design will be conveyed to the designer after, and only after, the plans are complete.

Law No. 2: The more innocuous the revision appears to be at first, the further its influence will extend and more plans will have to be re-drawn.

Law No. 3: If, when the completion of a design is imminent, field dimensions are finally supplied as they actually are, instead of as they were meant to be; it is always simpler to start all over.

Law No. 4: Even if it is impossible to assemble a part incorrectly, still a way will be found to do it wrong.

OFFICES, NON-EXISTENT

The Bohemian Embassy, a coffee house of the beatnik variety, is listed in the yellow pages of Toronto's latest telephone book under "Consulates and Other Foreign Government Representatives."

PROGRESS REPORT

It is noted that automation appears in more and more unusual applications. Just recently an automated brick layer was introduced which is capable of laying 900 bricks an hour. Any day we expect to hear of the development of an automated hod-carrier capable of going to the corner tavern for the usual bucket of beer.

MATH OVER LIGHTLY

An aerodynamicist out for a stroll walks eastward at the rate of 3 mph. He notices that the wind appears to blow directly from the north. He doubles his speed and the wind appears to blow from the northeast. What was the wind velocity? (answer on page 58.)

Mathematics Magazine

IMPORT-EXPORT FASTENER

The engineers at Dumont Industrial Screw have designed and developed a dual bolthead, import-export fastener. They claim the fastener is an outstanding example of how American companies can take steps toward eliminating friction between countries. The upper head is made to receive standard American wrenches, and the lower one is designed with a metric configuration for foreign use. For either case, it eliminates the need for a second set of wrenches. Sports car enthusiasts are outspoken in their praise and "wish it had been developed before I bought mine."

SHAKESPEARE ON FASTENERS

Even in Shakespeare's time, the importance of fasteners was known, as this quote from Macbeth points out:
"Screw your courage to a sticking place, and we'll not fail."

COOL, MAN, COOL

We wonder for whose benefit a Wheaton, Ill. undertaker had a sign installed over his establishment which reads "Air Conditioned for Your Comfort"?

LIMERICK CORNER

Govt. bans artificial holes in Swiss Cheese—News item.

There once was a cheesemaker, named
Brand,
Who, when told of the government's stand,
Replied, "In the making of Swiss,
I would deem it remiss
If all obsolescence were planned."

It often requires more bravery to tell the simple truth than it does to win a battle.—Josh Billings

Announcing

HITCHCOCK'S ASSEMBLY & FASTENER DIRECTORY

A NEW SERVICE TO HELP SOLVE YOUR ASSEMBLY PROBLEMS—FROM DESIGN THROUGH PRODUCTION

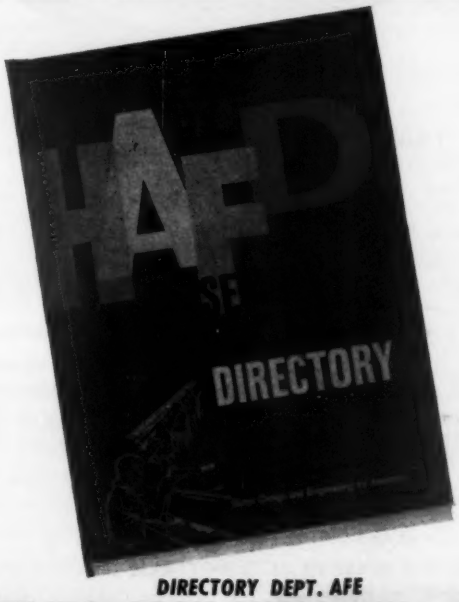
This new Hitchcock Directory will put at your fingertips the most complete listing of products and suppliers ever compiled serving the assembly field. Suppliers' names, addresses, products and services will be **sectionalized by assembly methods.** These include mechanical fasteners, spring and wire forms, hardware, resistance welding, brazing and soldering, bonding, seals, portable power and hand tools, assembly equipment and fastener manufacturing equipment and materials.

Valuable engineering data on standards, finishes, strength of joints, torque, materials and other subjects will be included in tables and chart form.

A special trade name section will list products commonly known by their trade names, describe the products and identify the manufacturer. Another section on associations will contain an up-to-date list of important trade and professional groups serving the industry.

The Directory will be bound in hard covers, measures 8½ x 11½ inches, and is planned to answer many questions with which you are confronted in day-to-day assembly problems.

Reserve your copy now at the special pre-publication price of $7.50, $2.50 under the $10.00 cost at publication. Early orders are assured the first copies off the press in September. Be sure to take advantage of this pre-publication savings and reserve your copy with the handy coupon at the right.



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PD—1—43—00

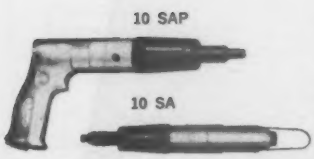
for the first time in air tool history Cleco offers--

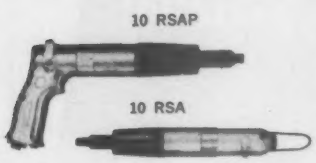
Trademark

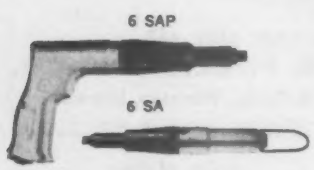
EXCLUSIVE ONE YEAR WARRANTY

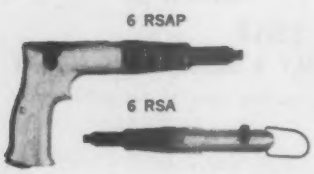
. . . on Clecomatic screwdrivers and nutrunners!

New Cleco warranty—the first one year warranty ever offered —is effective now on CLECOMATIC Golden Circle Air Tools









Performance Superiority Leads to Warranty. Extensive tests and industry usage have proved that CLECOMATIC screwdrivers and nutrunners assure the operator of trouble-free performance in the most rigorous and exacting jobs. In view of these outstanding performance results, Cleco management and engineers offer this unprecedented one year warranty—fully confident that CLECOMATIC screwdrivers and nutrunners will continue to provide trouble-free operation for all industries.

Look For The Golden Circle. For quick identification of trouble-free CLECOMATIC screwdrivers and nutrunners, Cleco will designate these tools Golden Circle Air Tools, a new symbol for quality workmanship. At present, No. 6 and No. 10 Series CLECOMATIC non-angle head screwdrivers and nutrunners will carry the one year warranty of Golden Circle Air Tools.

CLECOMATIC screwdrivers and nutrunners included in this line are the No. 6 SA, 6 RSA, 6 SAP & 6 RSAP (in speeds of 1000, 2000 & 3000 rpm); and the No. 10 SA, 10 RSA, 10 SAP & 10 RSAP (in speeds of 500, 1000, 1500 & 3000 rpm).

What One Year Warranty Means. Cleco's exclusive one year warranty assures the buyer that Golden Circle Air Tools are guaranteed for one year from date of purchase to be free from defects in workmanship and material under normal operating conditions. Warranties are included with each product purchased. To redeem your warranty simply return the tool to your nearest Cleco division or branch office, or direct to the factory in Houston, Texas.

Why Is CLECOMATIC The Best? • Positive, completely automatic torque control. • Air is automatically turned on when work is engaged. • Air is automatically cut off at pre-set torque. • Lowest air consumption of any air tool of comparable size and capacity because motor can run only while on work. • Non-friction clutch and no-drift locking device maintains constant torque. • Practically no torque reaction. • Built-in automatic oiler on pistol grip handles.

Call your nearest Cleco office or representative for complete information. In your next air tool order, be sure to specify Clecomatic Golden Circle Air Tools.

CLECO
AIR TOOLS

"quality tools engineered for industrial progress"

A Division of Reed Roller Bit Company • P. O. Box 2541/Houston 1, Texas, U. S. A.

IN CANADA: Cleco Pneumatic Tool Company of Canada, Ltd., 927 Millwood Road, Leaside (Toronto), Ontario

Use postpaid card. Circle No. 221

WHAT'S NEW IN EQUIPMENT

For information on any equipment listed here, use the postpaid card opposite page 58. Just circle the number on the card matching the number following the description. We'll do the rest.

PNEUMATIC IMPACT WRENCH HAS HIGH RUN-DOWN SPEED

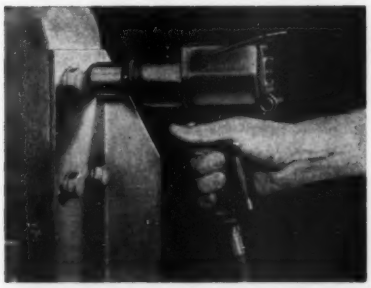
A lightweight, pneumatically operated impact wrench withstands the abuse of high production.

The impact mechanism of the wrench does not rely on springs or centrifugal force for operation. A high run-down speed is incorporated in the wrench, which operates on low air consumption. Another feature of the tool is that it is reversible.

The model 625 is furnished with a ½" drive square, and the model 626 is furnished with a ⅝" drive square.

Airetool Manufacturing Co., 328 S. Center St., Springfield, Ohio.

Use postpaid card. Circle No. 1



See No. 1

WELDING CLAMP MADE OF BERYLLIUM COPPER

A special welding clamp permits mounting in any position within ¼" from the arc. The clamps are especially useful when welding rounds to flats.

The spindle of the new welding clamp is made of solid beryllium copper which eliminates the necessity of using special coatings and protective shields. Spatter will not stick to the spindle or to the body of the clamp.

The welding clamp has all the standard features of United's general purpose clamps. They are quick closing and opening. The threadless spindle eliminates frame twisting when tightened. The anvil and spindle will not turn as pressure is applied and materials held are free from clamp marks. The clamps are available with either anvil or vee spindles and may be obtained in 2", 4" and 6" sizes.

United Associates, 1605 N. Hercules Ave., Clearwater, Fla.

Use postpaid card. Circle No. 2

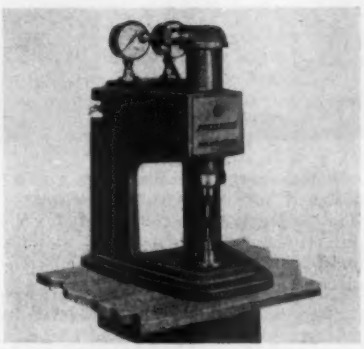
See No. 2

ASSEMBLY TOOL PRESSES STAKES AUTOMATICALLY

Independent pressing and staking forces adjust from lightest tap to 1-ton in high speed, fully automatic assembly tool. Standard interchangeable tooling adapts to a wide variety of work, and can be changed by the operator in less than a minute. Lower part of tool fits into work bench for ideal working height.

Cramer Controls Corp., Centerbrook, Connecticut.

Use postpaid card. Circle No. 3



See No. 3

EYE PROTECTION CHART FOR WELDING OPERATIONS

Chart gives the correct shades of glass to be used for proper eye protection in all welding and cutting operations.

The simple design of the chart enables the answer to be obtained immediately to the question of what shade of lens to use for a particular operation. On the left of the chart are the various soldering, brazing, cutting, and welding operations. On the right are listed the correct shade numbers to use for each process. Copies are available at 50¢ each, or 10 charts for $4.50.

American Welding Society, Technical Dept., 33 West 39th St., New York 18, New York.

Use postpaid card. Circle No. 4

AUTOMATIC FEEDER-DRIVER FOR SOCKET SET SCREWS

Key features in a fully automatic socket screw feeding and driving unit are its reduced power consumption, elimination of moving parts in the feeder hopper mechanism, and provision for fully automatic fixed cycle operation. The unit is also compact, requiring a bench area less than 13" x 21".

Not only can the machine itself be moved from one location to another, but the gun-type driver will automatically receive and drive screws at distances 25' and more from the machine.

The Bristol Company, Waterbury 20, Connecticut.

Use postpaid card. Circle No. 5

COAX CABLE STRIPPING UNIT IS BENCH MOUNTED

A machine for stripping braided wire shielding from coaxial cable and shielded wire is bench mounted.

The shielding stripper is available in two models. Model 15 can cut shielding lengths from ½" to 1½" and model 35 cuts lengths from ½" to 3¼". The lengths are infinitely variable within the limits.

Cadre Industries Corp., Endicott, N.Y.

Use postpaid card. Circle No. 6

LIGHT DUTY BALANCERS FOR HAND TOOLS

Two and four pound lift capacity balancers have the same features as larger balancers, Models 65B-0 and 65B-1 will handle small tools weighing up to two and four pounds respectively.

These balancers are made of heavy cast aluminum with oversize mainshaft and bearings. The 1/16" diameter 5' strand steel cable assures long trouble-free service. Precision engineered mainspring provides smooth, even pull.

Gardner Denver Co., Quincy, Ill.

Use postpaid card. Circle No. 7

DISC ACCESSORY ADDED TO ILLUMINATED MAGNIFIER

Illuminated magnifiers for inspection work can be equipped with a battley disc accessory for fine inspection and identification work.

The battley disc fits into the bottom housing of 5X and 7X Flash-O-Lens models. It has a series of concentric circles for fine inspection and identification work.

E. W. Pike & Co., Inc., 711 Pennsylvania Ave., Elizabeth, N.J.

Use postpaid card. Circle No. 8

RETAINING RING PLIERS AVAILABLE IN NINE SIZES

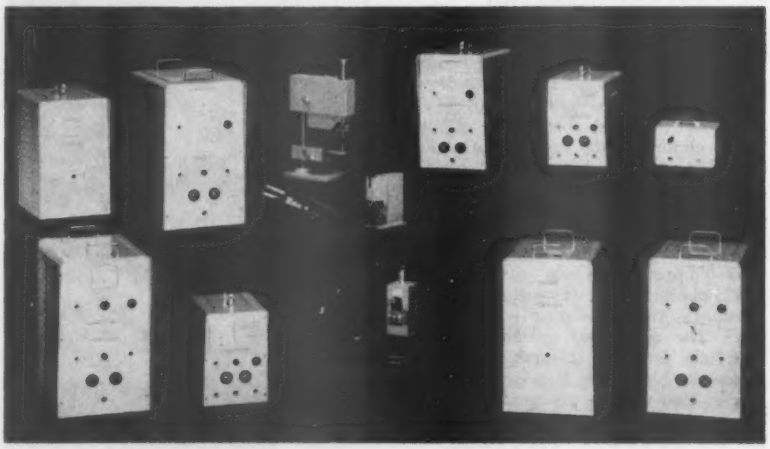
A fixed tip plier for retaining ring applications have tips which range in size from .022" to .090". They include three straight tip and five angle tip styles. Also available are "C" ring tips for crescent and "E" type rings.

The Milbar snap ring tools are made of alloy steel with a bright chromate finish. They are available in industrial sizes with micrometer type stop.

The Milbar Corporation, 1900 Euclid Ave., Cleveland 15, Ohio.

Use postpaid card. Circle No. 9

WELDER EQUIPMENT FOR ELECTRONIC CIRCUITRY



Stored-energy welding equipment designed for manufacturers of precision electronic components includes six different stored energy power supplies and five different weld heads and handpieces.

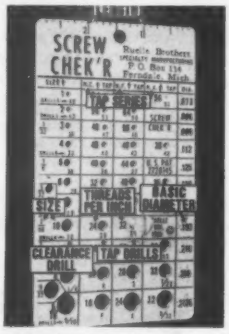
Sizes and ratings are designed to enable selection of a setup to meet any of the needs of manufacturers of relays, tubes, transducers, pots, thermocouples and high density component packages.

The Hughes welding power supplies include ultra short discharge time, fully metered controls, input voltage regulation and are made so that they can be used on standard production benches without need for special installations.

Vacuum Tube Products Div., Hughes Aircraft Co., 2020 Short St., Oceanside, California.

Use postpaid card. Circle No. 10

POCKET GAGE GIVES SPECS ON STANDARD FASTENERS



Screw Check'r is a device which tells the size, thread count, proper tap drill size, correct clearance drill size, length, tap series and basic diameter for bolts, cap screws and machine screws up to 5/16" diameter.

The 3" x 5" gage, made of Delrin, can also identify size and length for wood screws, sheet metal screws, self-tapping screws, standard rivets and most common cotter pin sizes.

Ruelle Brothers, PO Box 114, Ferndale 20, Michigan.

Use postpaid card. Circle No. 11

TOOLS COMBINED TO MAKE VERSATILE HOLDING CLAMP

The new torque thumb screw swivel pad clamp is a combination of the Vlier torque thumb screw, a holding tool which applies a controlled end pressure, and the swivel pad clamp, which permits a part to be securely held without marring its surface.

The new tools are available as standards in four sizes ¼-20 x 2½, to ½-13 x 3.

Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46, Calif.

Use postpaid card. Circle No. 12

AUTOMATIC UNIT COUNTS & BATCHES PARTS, FASTENERS

A high speed, fully automatic, electronically controlled parts counter can handle up to 450,000 items per hour.

The model 620 handles a variety of parts sizes and shapes ranging from paper clips, ball bearing assemblies and fasteners of all types. It can handle items which weigh between .01 and 2.5

ounces, and sizes ranging up to about 2".

Applications include packaging, prepackaging, inventory control, incoming inspection and production batching.

Atronic Products, Inc., 1 Bala Ave., Bala-Cynwyd, Pennsylvania.

Use postpaid card. Circle No. 13

ROTARY INDUCTION UNIT FOR MINIATURE ASSEMBLIES

The Reevelec Roto-Heaters are designed to meet requirements for high speed precision heating of various parts and assemblies.

Parts which previously could not be soldered with induction heating, such as miniature components, can now be soldered with little or no flux within a few seconds.

The electronic timer featured in the unit has an accuracy of .01 second.

Reeve Electronics, Inc., 609 W. Lake St., Chicago 6, Ill.

Use postpaid card. Circle No. 14

TOGGLE PLIER SERIES HAS 1600 LBS CLAMPING FORCE

Featuring long, comfortable handles the P-1600 plier is designed to apply a clamping force of 1600 lbs. at the spindle on application of normal hand pressure. It is available with a throat depth of 2¼ inches and throat gaps of 1-3/16", 3", 4" and 6". Manufactured from steel forgings these pliers are heat-treated and cadmium plated.

Lapeer Manufacturing Co., 3053 Davison Rd., Lapeer, Mich.

Use postpaid card. Circle No. 15

TIERED CIRCULAR PARTS BIN FOR ASSEMBLY BENCH USE

Designed to save floor space, labor and time in the handling of small parts, the Spin-A-Bin four-tiered circular parts bin, is ideal for use on assembly benches, small parts storage in stock rooms and tool cribs.

The four tier unit has 20 divided sections. All parts are of heavy welded steel construction, with an easy working revolving mechanism.

Walker Manufacturing Co., 1505 Broadway, Cleveland 15, Ohio.

Use postpaid card. Circle No. 16

SOLDERING MACHINE FOR PRINTED CIRCUITS

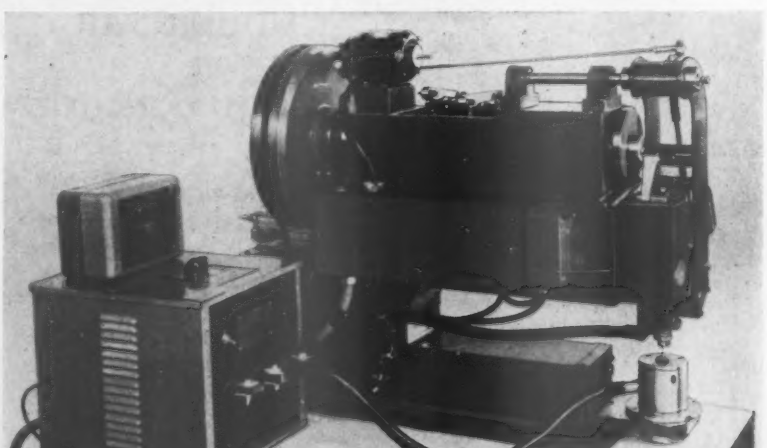
A modular system for soldering printed circuits and in-line terminals consists of a spacer, foam fluxer, preheater, solderer, cooler, cleaner, and dryer units.

Production speed of the Adawave unit is adjustable from zero to four feet per minute.

Compo Shoe Machinery Co., 125 Roberts Rd., Waltham 54, Mass.

Use postpaid card. Circle No. 17

EYELETING UNIT PROCESS MEETS MIL. STANDARD 275A



The Model TW eyeleting unit automatically feeds, sets and resistance fuse eyelets as small as .020" inside diameter to boards as thin as 1/64".

The process, which is specified in Mil Std. 275A, has proved itself through environmental tests of all types and in actual production operations. Although designed primarily for forming reliable through connections, the unit also offers high speed operation and low operating cost.

Edward Segal, 132 Lafayette St., New York 13, N.Y.

Use postpaid card. Circle No. 18

HOPPER FED TUBULAR RIVETER IS PORTABLE

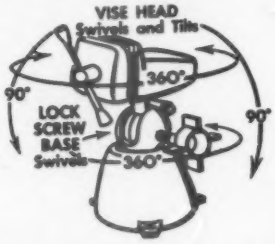
The Electrorivet is designed to automatically feed and set tubular rivets and other small fasteners up to ⅛" diameter. The light, portable riveter can be shifted from job to job, easily and quickly.

The model SMR combines the hopper feed system employed by Milford Rivet and Machine Co., for tubular rivets and the Electrostake.

Black and Webster, Inc., 570 Pleasant St., Watertown 72, Mass.

Use postpaid card. Circle No. 19

VISE HOLDS WORK IN ANY DESIRED POSITION



Suitable for assembly line application and adaptable to any fixture with a ⅝" diameter shaft extension, an adjustable work position vise locks rigid in any set position.

The vise head, or fixture, can be pivoted 360° on any tangent to a half sphere to achieve any compound angle. A single lock screw holds the head or fixture in the desired position.

Colbert Die Cast Co., Inc., 10107 Adella Ave., South Gate, Calif.

Use postpaid card. Circle No. 20

DUAL SPINDLE SCREWDRIVER HAS AUTOMATIC FEED

A dual spindle automatic screwdriving machine has two air-fed screwdrivers with Tru-Tork nose pieces and a special double track oscillating hopper with two metering devices.

Screws are simultaneously metered and driven while operator positions next part on the fixture. The machine uses normal shop air pressure to operate driving heads and 40 lb. pressure to operate the metering device which feeds screws.

Clyde Engineering & Manufacturing Co., 937 E. 10 Mile, Madison Heights, Michigan.

Use postpaid card. Circle No. 21

PLASTIC BOX STORAGE RACKS ARE FREE STANDING

Designed for easy removal of the plastic boxes, storage racks, available as free standing, double or single wall units are capable of handling up to 224 PB-1 Plastiboxes or combinations.

G. B. Lewis Co., Department PBA, 828 Montgomery St., Watertown, Wis.

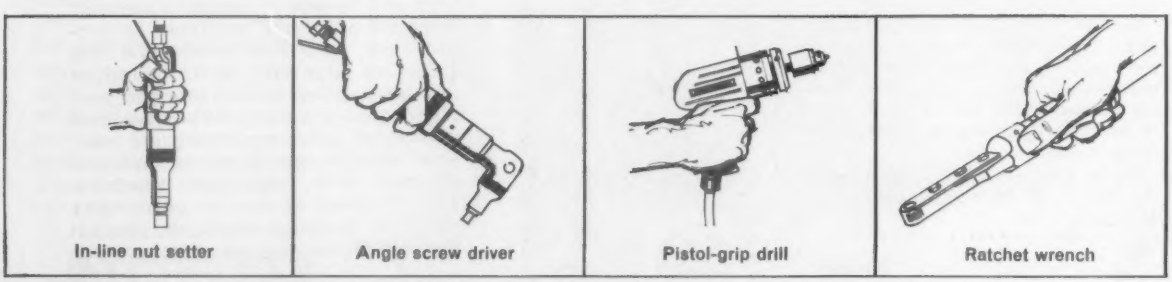
Use postpaid card. Circle No. 22

Getting the most from the hands you hire

In tight places as shown above, or where elbow-room is plentiful, Gardner-Denver can provide exactly the right air tool to keep expensive hands working at top efficiency.

Each air motor size provides the basic "building block" for hundreds of different tools—assuring versatility and interchangeability to keep pace with production changes.

For details, see your Gardner-Denver air tool specialist or write for bulletins.



EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

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Use postpaid card. Circle No. 225

WHAT'S NEW IN FASTENING AND JOINING

For further information on any of the fasteners or methods use the handy postpaid card opposite page 58.

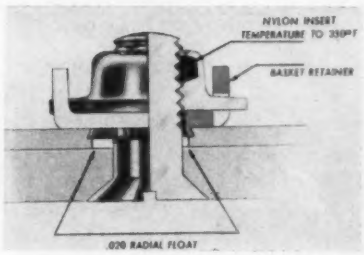
SELF-LOCKING CLINCH NUT FOR BLIND FASTENING

Greater tolerances for mating assemblies and simplified installation methods are the advantages offered to the user by the new floating clinch nut design. These self-retained clinch type blind fasteners Type NC4284 provide load bearing threads in thin sheet metal assemblies such as electronic chassis, instrument panels and cover plates.

The self-locking nuts are manufactured both from carbon steel and 18-8 stainless in machine screw sizes No. 4 to 10.

Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N.J.

Use postpaid card. Circle No. 31



See No. 31

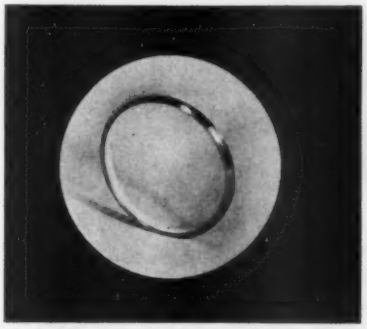
TEFLON-STAINLESS SEALS FOR HIGH-TEMP & PRESSURE

A two-stage static seal in which a high yield-strength stainless steel V-ring seal is preceded by a Teflon seal is designed to operate at temperatures from —65° F to 600° F and under pressures up to 10,000 psi.

The outer ring, made of high yield-strength Armco 17-4PH stainless steel, maintains the seal under extreme temperatures and pressures. The Teflon primary seal, permanently joined to the metal component, provides a "soft seat" for completely leak-tight sealing. The units are re-usable.

Pall Corporation, 30 Sea Cliff Ave., Glen Cove, N.Y.

Use postpaid card. Circle No. 32



See No. 32

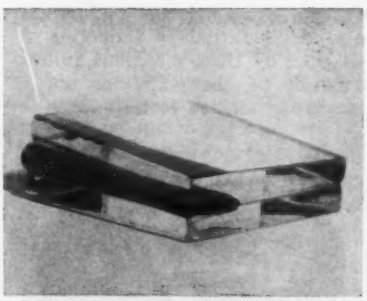
EXTRUDED SEALER PERMITS SEALING OF TAPER JOINTS

Two extruded rubber base sealers with a cross sectional "double-donut" design permits positive sealing of uneven or tapered joints. They can be bent 90° without the need of cutting or fitting.

The sealers, one hollow, the other solid, are designed to seal between mating metal surfaces. They act and perform as a gasket when pressed into a seam and tightened between the sealing surfaces.

Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Use postpaid card. Circle No. 33



See No. 33

HANGERS FIT STANDARD ROTATING COMPONENTS

Precision hangers are available in two heights and a wide range of bore sizes to fit standard rotating components. They are also available in blank state for use with non-standard size components.

These hangers are manufactured from aluminum alloy castings, machined with precision accuracy for squareness, and finish is black anodize. The mounting centers are spaced for use with most existing bread board plates.

Sterling Precision Corp., Component Division, 5 Sintsink Dr., Port Washington, L.I., N.Y.

Use postpaid card. Circle No. 34

FLUX-COATED ALLOY FOR SILVER BRAZING USE

A flux-coated alloy for silver brazing, 1020FC, makes application of silver alloys convenient and fast because the need for mixing and applying a separate flux is eliminated. It can be used for joining all types of metals, both for maintenance and production applications.

Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N.Y.

Use postpaid card. Circle No. 35

HIGH TENSILE STRENGTH CAP SCREWS IN LARGE DIAMETERS

An extra heavy duty line of high tensile strength cap screws in diameters up to 3½" and lengths up to 30" are designed to eliminate the high expense and costly down-time delays formerly

required for custom manufacture of cap screws in very large sizes.

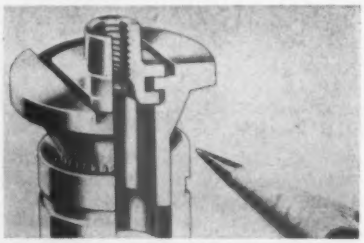
The heavy duty cap screws, in diameters beginning at 9/16th of an inch and lengths beginning at 6 inches, are an extension of the company's cap screw line.

Average minimum tensile strength for Supertanium cap screws is 160,000 psi, compared with 65,000 pounds or less for ordinary cap screws. A corrosion-resistant finish also permits easy removal of the cap screws for machine maintenance.

Premier Industrial Corp., 4415 Euclid Ave., Cleveland 3, Ohio.

Use postpaid card. Circle No. 36

FLOATING LOCKNUTS FOR HONEYCOMB PANELS



Structural floating locknuts for honeycomb or sandwich type panels provide many advantages and savings over the use of standard floating nut plates.

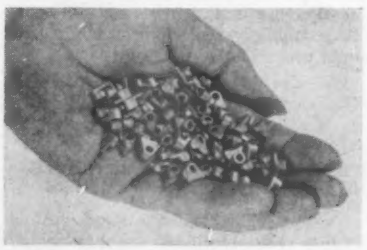
The Delron 700 series combines a floating nut element with a structural type panel fastener. Simple installation procedures eliminate the need for intricate hole patterns and secondary riveting operations now required for conventional nut plates. The floating action of the 700 series fastener allows for total misalignment of 1/16 of an inch.

The locknuts are available for ¼" panels and up, in sizes from 8-32 to ¼-28. Body section can be purchased in aluminum, carbon or stainless steel.

The Delron Co., Inc., 5224 Southern Ave., South Gate, Calif.

Use postpaid card. Circle No. 37

ALUMINUM SERVO MOUNTING CLAMPS



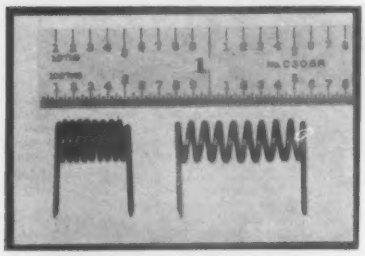
Two clamp sizes made for use as standard mounting hardware for synchros, servo-motors, and pots. Each clamp size is anodized in a different color and may be used to fasten as many as six different housing sizes to the mounting panel.

Each piece is machined from solid aluminum stock to provide greater strength under shock and vibration than conventional powdered metal and stamped construction.

Theta Instrument Corp., 520 Victor St., Saddle Brook, N.J.

Use postpaid card. Circle No. 38

WIRE RETAINER FOR HARNESS BOARD ASSEMBLY



Wiretainers are designed to provide a firm grip on individual wires while wiring any type of harness board. With a single motion each wire is secured until all wires are ready for lacing. The unit maintains an orderly harness board, eliminates the practice of using tape, tacks or other means which can harm wires during layout.

They are available in 2 categories; narrow gauge for wires from .010 to .040 and broad gauge to hold wires from .045 to .080. Either gauge is available to hold from 2 to 12 wires inclusively.

Holtronics, 7100 Avalon Blvd., Los Angeles 3, California.

Use postpaid card. Circle No. 39

PRECISION SHAFT LOCKS FOR SHAFT TYPE CONTROLS

An improved series of precision shaft locks, for use on potentiometers, capacitators, coils and other shaft type controls, is stocked in two styles, knurled hand nut or wrench hex nut. These collet type locks are available for ⅛" and ¼" shafts, in clear passivated stainless steel or black anodized aluminum.

PIC Design Corp., 477 Atlantic Ave., East Rockaway, Long Island, N.Y.

Use postpaid card. Circle No. 40

CLOSED ENTRY TEST JACK FOR .032" DIAMETER PROBE

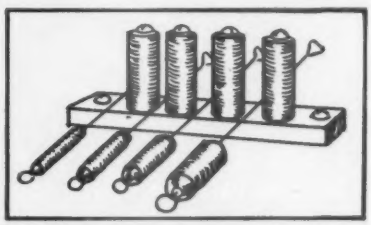
A closed entry test jack utilizing the press-fit mounting principle is designed to receive a .032" diameter probe, to a depth of .200" maximum. The closed entry assures perfect alignment of the probe in test operations. Contacts are beryllium copper, designed for maximum service life.

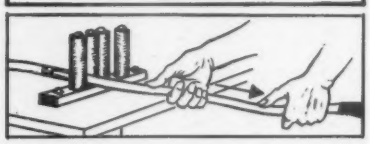
The SKT-34 provides a double-turret stud on the reverse side of the chassis for termination of associated circuitry. The teflon body is .148" in diameter, with a .172" diameter above-the-chassis shoulder.

Sealectro Corp., 610 Fayette Ave., Mamaroneck, N.Y.

Use postpaid card. Circle No. 41

CABLE SLEEVER QUICKLY THREADS WIRING HARNESS





A cable sleever which can be handled by one operator provides a fast easy way to thread wiring harness through plastic sleeving.

The "Little Joe" cable sleever will accommodate sizes from ¼" up to 2" OD. Up to 150' of harness can be covered in 10 minutes.

MacDonald & Co., 714 E. California St., Glendale 7, Calif.

Use postpaid card. Circle No. 42

BINDING POSTS GIVE LOW LOSS & POWER FACTOR

Newly designed binding posts feature polycarbonate resin molded parts, which incorporate a combination of properties well suited to their function.

Superior 5-way binding posts are rated for a current capacity of 30 amps, and a working voltage of 1000 volts. They have a high impact strength over a broad range of temperatures.

Superior Electric Co., Dept. LBP, Bristol, Conn.

Use postpaid card. Circle No. 43

STAINLESS BALL PLUNGERS FOR ASSEMBLY MACHINE USE

All ten sizes of company's ball plungers are now available as standards in stainless steel.

The Vlier ball plunger is a compact, spring-loaded ball widely used in indexing automatic feed devices, for gear shifters, as locators in progressive dies, in torque limiting clutches, for positioning levers in gages, anywhere a controlled end pressure is required.

They are available in sizes from 4-48 x .187 to ⅝-11 x .984, and in various end pressures. They may be ordered with or without Nylok.

Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46, Calif.

Use postpaid card. Circle No. 44

STAINLESS EXPANDER USED IN PLASTIC SEAL RING

An internal expander which maintains a continuous mechanical force against the sealing surface allows the use of Teflon as a sealing material.

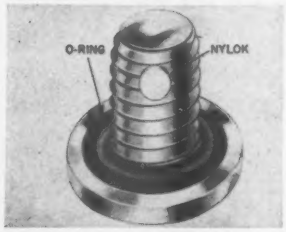
Tec-Ring employs either a stainless steel or any indicated synthetic rubber expander, depending upon the intended environment. The rings need no adjustment and range in size from 1/8" to 15" id.

In a recent test the ring used as a rod seal allowed no perceptible leakage after 400,000 cycles at 3,000 psi, 400° F. It has also performed well under other extreme conditions and environments.

Tanner Engineering Co., 1003 Santa Fe Ave., Los Angeles 21, Calif.

Use postpaid card. Circle No. 45

SELF-SEALING FASTENERS AVAILABLE WITH NYLOK

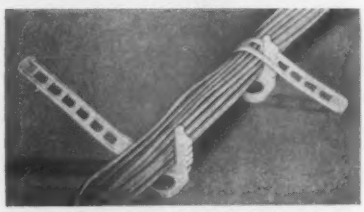


High-pressure, self-sealing fasteners can now be obtained with a resilient nylon pellet imbedded in the threaded area for added reliability and thread locking action. Available in the company's line of one-piece Seel-Skrews and Seelbolts, the Nylok feature supplements the locking action of the o-ring under the fastener head and provides increased protection against shock and vibration.

A. P. M. Corporation, 41 Honeck St., Englewood, N.J.

Use postpaid card. Circle No. 46

CLAMP FOR TEMPORARY OR PERMANENT CABLE ASSEM.



Clamp for both temporary and permanent assembly requires no tools for fast, easy clamping and hanging of bundles or single cables.

Tab-Loc clamps are adjustable from 3/8" to 3/4" diameter bundles. Easily opened for adjustment, removal or addition of wires, they are also reusable.

The clamps are made of solid nylon to provide maximum dielectric strength and corrosion resistance. They are supplied in natural color.

Weckesser Company, Inc., Dept. AE-3, 5701 Northwest Highway, Chicago 46, Ill.

Use postpaid card. Circle No. 47

Answer to problem on page 44. The wind velocity is the diagonal of a square vector diagram, and thus 3 times the square root of 2 miles per hour.

assembly and fastener engineering

JULY, 1961

(Not valid after September 30, 1961)

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USEFUL LITERATURE

To receive your copy of any literature reviewed here, use the postpaid card opposite page 58.

EPOXY SELECTION CHART

A systems selector for epoxy insulation shows the properties of selected electrical insulating compounds. The selector contains helpful data on insulation selection, and charts handling characteristics and physical and electrical properties. Hysol general purpose casting and potting compounds, compression and transfer molding powders, dipping compounds, and conductive cements and coatings are listed. Electrical Insulation Div., Hysol Corporation, Olean, N.Y.

Use postpaid card. Circle No. 61

ASSEMBLY MACHINES

The concept of basic assembly dial type machines is covered in four-page bulletin. It covers such aspects as considerations of standard machines over special machines on production runs, the basic construction of the units, and capabilities of indexing machines. The Bodine Corporation, 317 Mountain Grove St., Bridgeport 5, Conn.

Use postpaid card. Circle No. 62

SILICONE RUBBER

Uses of room temperature vulcanizing silicone liquid rubber is described in ten-page bulletin. Applications for encapsulation of electronic and electrical assemblies, and use as sealers and moldings is also described. General Electric, Silicone Products Dept., Waterford, N.Y.

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RUST PENETRANT

Application and quality of rust penetrant is described in information sheet. Included also is description of new packaging design of applicator, including a telescoping-spout. Armite Laboratories, 6609 Broad St., Los Angeles 1, California.

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THREAD-CUTTING SCREWS

A six-page catalog, Form 276, describes and illustrates three new thread-cutting screws. The literature gives complete information on design, sizes, material applications, recommended hole sizes, and drill size and minimum penetration in blind holes. Numerous photographs, isometric and artist's drawings, tables, and charts illustrate the material. In addition, two pages are devoted to a simple test that enables a user to determine for himself comparative evaluation of thread-cutting screws. Parker-Kalon, Clifton, New Jersey.

Use postpaid card. Circle No. 65

EYELET SELECTION

Proper selection of correct eyelet and eyelet setting tool is simplified with convenient slide rule type selector. Information shown on the chart, gives hole size, drill size, metric equivalent, eyelet shoulder and shank size and grip length, standardized eyelet stock number, and proper eyelet setting tool. Reverse side of the rule provides information for quick conversion from fractions to decimal equivalents, nearest number or letter drill, and nearest metric drill size. United Shoe Machinery Corp., 140 Federal St., Boston 7, Massachusetts.

Use postpaid card. Circle No. 66

SPRING PINS

Ten-page technical data manual gives description and special characteristics of coil spring pins. Engineering drawings and specification charts and details of shear and shock resistances are also included. C. E. M. Company, Inc., 24 School St., Danielson, Conn.

Use postpaid card. Circle No. 67

PRINTED TAPE TERMINATORS

Elimination of scraping, abrasing, sanding or polishing and heating by use of special terminators for continu-

See No. 65

See No. 66

See No. 67

ous conductive tape and printed flexible tape is described in four-page engineering folder. Standard engineering drawings and specifications are shown for the various types of terminators being made. Hi-Shear Corporation, 2600 W. 247th St., Torrance, Calif.

Use postpaid card. Circle No. 68

CONVEYOR FOR BENCH USE

An inexpensive, modular belt conveyor for bench operations is described in bulletin 260. The bulletin illustrates a number of accessories which adapt it to almost every production assembly operation. Products for Industry, Inc., 1704 Summer St., Stamford, Conn.

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WELDING MOTOR CASES

Seventy two-page booklet entitled Fabrication of Welded Motor Rocket Cases, covers materials, design, welding and quality control in the fabrication of rocket motor cases. Many useful tables are given on the standards of acceptance for radiographic inspection, mechanical testing, visual inspection and other methods of assuring the highest possible results. The booklet is priced at $2.50. American Welding Society, Technical Dept., 33 West 39th St., New York 18, N.Y.

Use postpaid card. Circle No. 70

ADHESIVE APPLICATOR

How to eliminate hand brush dipping and dangerous fire hazard of open-top cans of adhesive by use of pressure fed adhesive applicator is described in information sheet. Complete catalog description of types of applicators and pressure containers is also given. BB Chemical Co., Subsidiary of United Shoe Machinery Corp., 784 Memorial Dr., Cambridge 39, Mass.

Use postpaid card. Circle No. 71

TESTING MACHINES

Four-page bulletin G-361 describes literature available for set of testing machines. Included in the description are hardness, ductility, tensile and compression testing units, and services available from the company for special testing devices. Steel City Testing Machines Inc., 8817 Lyndon Ave., Detroit 38, Mich.

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QUICK-RELEASE PINS

Engineering drawings and specifications for company line of positive locking quick-release pins is described in two-color fold-out information sheet. Applicable military standards for steel pins, and cres pins are included. Gefco, P.O. Box 565, Burbank, Calif.

Use postpaid card. Circle No. 73

HAND TOOL CATALOG

General catalog No. 700 illustrates and describes the complete line, with 330 items not previously listed. The 132-page book gives complete information on all categories of tools in the company's line covering tool holders, set-up and hold-down tools, tool bits, machine shop specialties, wrenches, socket wrenches, wrench sets containing varied assortments of wrenches and detachable sockets, miscellaneous hand tools and pipe tools. Armstrong Brothers Tool Co., 5203 W. Armstrong Ave., Chicago 46, Ill.

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TRANSFER CHASSIS

Two types of transfer chassis for assembly line layout, the carrousel and the over-under conveyor, are described in four-page bulletin C-760. Included also is a numbered drawing showing a typical conveyor system layout. Visi-Trol Engineering Co., 12720 Burt Rd., Detroit 23, Mich.

Use postpaid card. Circle No. 75

PUMPS FOR MIXING RESINS

A ten-page booklet illustrates and gives complete specifications for 20 basic models of the Triplematic pump and the variations available of each model. The pumps proportion, mix and dispense two and three part multi-component resin systems in metered shots or continuous flow; low or high viscosity ranges. Also included is an outline of the technical services available from the company and a series of pertinent questions and answers about dermatitis, bubbly mixes, improper ratios, and excessive waste of short-pot-life materials. H. V. Hardman Co., Inc., Dept AFE, Belleville, N.J.

Use postpaid card. Circle No. 76

SPACERS AND BUSHINGS

Line drawings illustrate and describe uses of standard butted joint spacers and bushings. Included in the four-page brochure is information on range of sizes available, type of material, tolerances, chamfering, tooling and deliveries. E. R. Wagner Manufacturing Co., 4611 N. 32nd St., Milwaukee 9, Wis.

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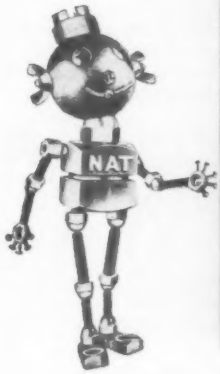
NAT'S
quick facts
about
Fasteners...



Welding Fasteners...

the little things that make a big difference

Welding Fasteners put threads into the most unlikely places, and make light of the weightiest assembly problems.

Where hands and wrenches can't get in, for instance, or where material dimensions or contours make it next to impossible to use regular fastening methods, Weld Nuts or Weld Screws neatly side-step the difficulties . . . and make assembly simple, fast and foolproof.

We could go on and tell you more about Welding Fastener advantages . . . in improving product design and quality, increasing production efficiency, and cutting costs . . . and we'll be very glad to, if you like.

Right now, though, we'd just like to say that when you need certain standard Weld Nuts or Weld Screws, and you want to be sure they're designed right and made right . . . that's where we come in. We *know* Welding Fasteners, and we *stock* many of the most commonly used.*

We might just mention, too, that we happen to be particularly adept at developing Special Fasteners for welding. They can often be designed to do a better job and save money for you. Ask us about your applications.

*Standard types and sizes are illustrated and listed in National's booklet on Welding Fasteners. Write for your copy.

National PRODUCTS

The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

Use postpaid card, Circle No. 236

COMPONENT INSERTING UNIT

Series of technical information sheets describe several models of electronic component inserting machines. Each machine is fully described and photographs show typical use in assembly and production runs. Descriptive specifications for each unit include standard equipment, optional equipment available, capacity, power requirements, weights and dimensions, and production information. United Shoe Machinery Corp., 140 Federal St., Boston, Massachusetts.

Use postpaid card. Circle No. 78

MIDGET AIR CYLINDERS

Adjustable stroke midget air-clamp cylinders are some of the pneumatic production tools and units described in 56-page catalog. Included in the catalog are complete diagrams and specifications of single-acting air cylinders, double cushioned air cylinders, and assembly, punching, peening, riveting and crimping units. Mead Specialties Co., 4116 N. Knox, Chicago 41, Ill.

Use postpaid card. Circle No. 79

PREFORM ALLOY CHART

An alloy preform selector chart which is offered at no charge to semi-conductor engineers. The chart lists 56 different alloys arranged in order of solidus and liquidus temperatures. Each of the alloys listed is workable, and available as preforms such as discs, washers or spheres. Accurate Specialties, 345 Lodi St., Hackensack, N.J.

Use postpaid card. Circle No. 80

CLAMP CATALOG

A new product catalog describes in detail the new line of high tensile strength aluminum threadless-spindle clamps. The catalog gives a description of the three types of clamps developed to date; the standard frame, the welding, and the deep-throat line of United Clamps. In addition, it gives complete range of sizes, prices, shipping information, the range of spindle types and materials, and accessories that are currently available. United Associates, 1605 N. Hercules Ave., Clearwater, Fla.

Use postpaid card. Circle No. 81

PORTABLE ELECTRIC TOOLS

Complete information, including detailed specifications, application of products and numerous photographs of each tool in use is given in 34-page buying guide describing 72 portable electric tools. More than 400 accessories are included in the catalog listing. Porter-Cable Machine Co., Syracuse 1, New York.

Use postpaid card. Circle No. 82

SPECIFICATIONS HOLDER

How to file plans and specifications with vertical or roll type filing equipment is shown in illustrated 12-page catalog 3-60. Each type of binder is listed with catalog number, and is shown with illustrations of typical engineering office use. Plan Hold Corp., South Gate, Calif.

Use postpaid card. Circle No. 83

FLOW CONTROL VALVES

Bulletin FVS-32861 contains data, illustrations and specifications on manual and motor driven flow valves. These valves are designed for the flow control and shut-off of free-flowing bulk materials such as carbon, dust, gelatine, plastic powders, etc., from bins, hoppers and chutes. Included in the bulletin is a complete description of the valves, new accessories, adapter spools and sleeves. Syntron Company, 820 Lexington Ave., Homer City, Pa.

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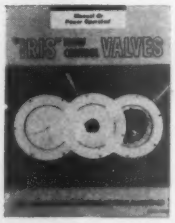


SOLDERING IRONS

Company's complete line of soldering irons is listed in catalog No. 61. Each iron is fully described, and special features are listed along with specifications and prices. American Electric Heater Co., 6110 Cass Ave., Detroit 2, Michigan.

Use postpaid card. Circle No. 85

WIRE CLIPS

Information sheet gives complete description of various wire clips and metal stampings, and their present uses. Also included is a photograph of the many configurations of standard clips now made. Gagnier Fibre Products Co., 10151 Capital Ave., Oak Park, Mich.

Use postpaid card. Circle No. 86

ADAPTER RINGS

An adapter ring which provides a strong, hard base to support a set of softer V-rings is described in data sheet. Included also are the environmental and mechanical characteristics of the rings. Greene, Tweed & Co., North Wales, Pa.

Use postpaid card. Circle No. 87

MATERIAL HANDLING

Complete line of material handling units and accessories are illustrated and described in eight-page catalog MF-100A. Details of standard components for material handling conveyor systems, as well as general specifications are also included. May-Fran Manufacturing Co., 1710 Clarkstone Rd., Cleveland 12, Ohio.

Use postpaid card. Circle No. 88

POWER PRESSES

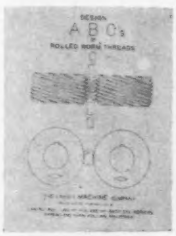
Solid one-piece crankshafts, one-piece semi-steel frame and precision balanced flywheel are some of the features of a power press described in four-page information folder. Included also are descriptions of arbor presses, air presses, squaring shears and milling machines. Famco Machine Co., 3154 Sheridan Rd., Kenosha, Wis.

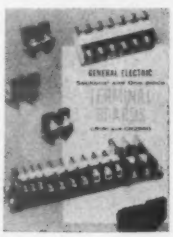
Use postpaid card. Circle No. 89

ROLLED THREAD DESIGNS

Ten-page design booklet fully illustrates and describes general rules of design and practice for rolled worm threads. Among the design items covered are; the effect of number of workpiece starts upon straightness; rotative effects of thread depths; effect of pressure angle and corner radii and blank design. Landis Machine Co., Waynesboro, Pa.

Use postpaid card. Circle No. 90





TERMINAL BOARDS

Bulletin GEA-7317, describes sectional and one-piece molded terminal boards, CR151 and CR2960, for use in panels, switchboards or any other equipment where it is desirable to group wiring connections. Photos show the eight individual sectional blocks available and many factory assembled sectional and one-piece terminal boards. General Electric Co., Schenectady 5, N.Y.

Use postpaid card. Circle No. 91

COST REDUCTION NEWS

Sample copy of news letter devoted to news and ideas which concern cost reduction in manufacturing is offered by company. The letter, issued monthly, covers market trends, literature reviews, tax subjects and general cost savings ideas. Subscription price is $18.00 per year. Wyatt & Morse, Inc., 332 S. Michigan Ave., Dept. AFE, Chicago 4, Ill.

Use postpaid card. Circle No. 92

CONDUIT & CABLE FITTINGS

Complete line of electrical conduit and cable fittings are listed in 60-page catalog No. 85. Each fitting is photographically described and detailed with engineering specifications and appropriate catalog stock number. Thomas & Betts Co., Inc., Elizabeth, N.J.

Use postpaid card. Circle No. 93

NEOPRENE ADHESIVES

The latest technical data on SP-134 heat-reactive, phenolic resin for industrial and general purpose elastomer adhesives is presented in four-page bulletin. Schenectady Varnish Co., Inc., 3303 Congress St., Schenectady 1, N.Y.

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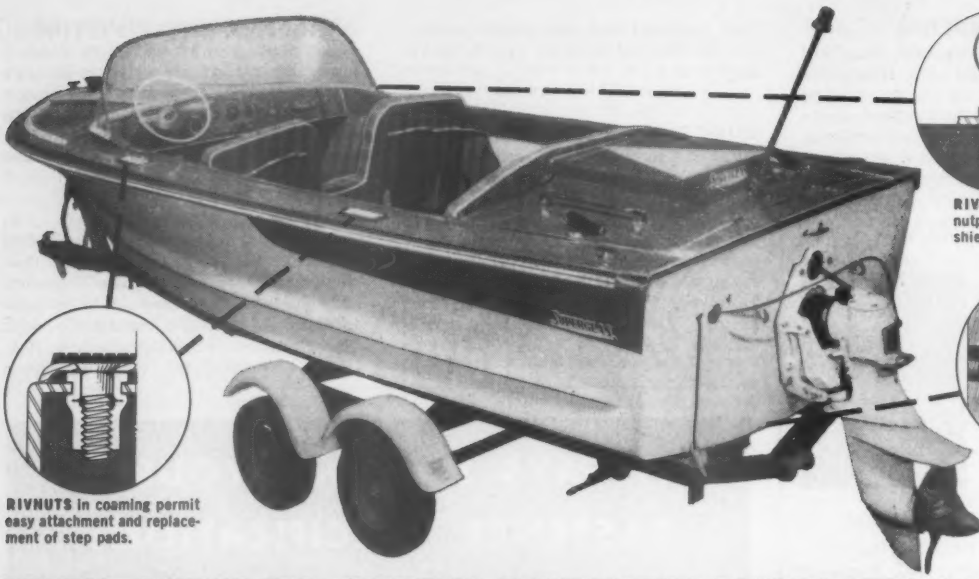

RIVNUTS in deck provide nutplate for fastening windshield bolt.

RIVNUT and screw function as drain plug for sealed compartment.

RIVNUTS in coaming permit easy attachment and replacement of step pads.

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RIVNUTS perform three different fastening jobs in this sleek boat manufactured by Superglas Corporation, Nashville, Tennessee. The three applications are all "blind" —thus RIVNUTS, which can be quickly installed from the exterior, simplify assembly and save production time. In addition, fastening is strong and vibration proof. For complete information on how RIVNUTS can improve your fastening operations write for copy of RIVNUT Data Book. *Dept. AE-7, B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio. In Canada: Kitchener, Ontario.*

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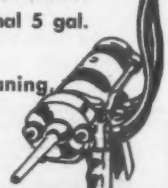

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INDUSTRY MAKES NEWS

WATERBURY FARREL INCREASES PRODUCTION EFFICIENCY IN MODERN PLANT

Exterior of new 314,000 sq. ft. Cheshire, Connecticut plant of Waterbury Farrel Foundry & Machine Co., a division of Textron, Inc.

The Waterbury Farrel Foundry & Machine Co., a division of Textron, Inc., recently completed the move to its new facilities in Cheshire, Conn. The company produces cold heading machines, presses, and rolling mills, including the Sendzimir mills used for precision cold rolling of stainless steel and hard alloys.

The new, one story plant replaces a century-old multi-story, multi-building plant in downtown Waterbury. By eliminating the necessity for moving heavy machinery parts from one floor to another and by modernizing production flow, the new 314,000 square foot factory has substantially increased efficiency.

Although there is approximately 20% less floor space in the new production facility, it has the capacity to handle approximately 20% more volume than the older plant.

Automated line of bolt making machinery being given final tests before shipment from the new plant. These machines produce bolts one inch in diameter and eight inches in shank length at a rate of forty finished pieces per minute.

APRIL FASTENER SHIPMENTS

The seasonally adjusted fastener shipments for April, 1961 was 75% of the 1956-58 average.

While the shipments were off 1% from March, 1961, they are still at the average of shipments for the year. Shipments of fasteners in April, 1960, were at 92% of the 1956-58 average.

VALUE ANALYSIS INC. SETS UP NEW SERVICE

A comprehensive new service, designed to pinpoint and remove all unnecessary costs in the manufacture of both industrial and consumer products was announced recently by J. K. Fowlkes, president of Value Analysis, Inc., Schenectady, N.Y. The company is a nation wide organization of value consultants providing industry with value analysis training seminars and management guidance programs aimed at both preventing and eliminating unnecessary costs.

"As an ever-increasing number of new products enter the market place, keen competition will place greater emphasis on quality and price. Management must keep a constant eye on costs," Fowlkes stated.

Companies contracting for the service will have their product reviewed by product evaluation personnel,

will will subject the product to a thorough value study, and submit recommendations for removal of unnecessary costs.

D. L. Egan will direct the new service from Value Analysis, Inc. headquarters in Schenectady.

TOMKINS-JOHNSON PROMOTES CURTIS

Robert L. Curtis has been advanced to sales manager of all products of the Tomkins-Johnson Co., Jackson, Mich.

Curtis joined T-J in 1950 in the engineering department. He has been associated with the tool and die and metalworking industry since his graduation from college.

SMITH WELDING CHANGES NAME

The board of directors of Smith Welding Equipment Corp., Minneapolis, has announced a new corporate name, the opening of a new division and a change of officers.

Smith Welding will become a division of Tescom Corporation, as will a new Fluid Systems Division, informally activated earlier this year.

Elmer H. Smith, chairman of the board for the Elmer Smith Co. of Minneapolis became honorary chairman of the Corporation. The new board chairman is L. L. McBurney, former president of the company. Jack E. Smith succeeds McBurney as president.

BRISTOL COMPLETES NEW BUILDING

The Bristol Co. recently completed construction of a new building to accommodate the manufacture of their new and complete line of socket screws with the Nylok self-locking element. The new building is located at the main plant in Waterbury, Connecticut.

KAHN NAMED PRES. OF PARKER-KALON

S. S. Kahn has been named president of Parker-Kalon, a division of General American Transportation Corp.

Kahn takes over the presidency of Parker-Kalon from William T. Ylvisaker, who was recently named executive assistant to the president of General American Transportation in Chicago.

With Parker-Kalon for 32 years, Kahn was formerly senior vice president. He also served as general sales manager and advertising manager.

Kahn started his business career with the Ford Motor Co. in 1926. He joined Parker-Kalon in 1928 in the sales engineering department.

ELECTED TO BOARD OF H. M. HARPER CO.

Charles L. Harper has been elected as a member of the board of directors of The H. M. Harper Co. He succeeds Robert T. Sherman who passed away recently.

Harper, manager of the company's Metals Division, joined the firm seven years ago as a member of the engineering staff.

OFFICERS FOR SCIENCE INSTITUTE

At their annual meeting in Washington, D.C. the Institute of Environmental Sciences elected Arthur B. Billet of Vickers, Inc., Detroit, Mich. as president. Other elected officials were: Donald J. Fox, Fenwal, Inc. Chicago, executive vice-president; Mark Christensen, Wyle Laboratories, El Segundo, Calif., vice president-fiscal; Gerhard Doering, Columbia Research Labs, Woodlyn, Pa., vice president—local chapter; Herbert J. Saunders, Vap-Air Div. of Vapor

Heating Corp., Chicago, vice president—membership; John D. Campbell, Philco Corp., Palo Alto, Calif., vice president—publications.

Henry Sander of Mt. Prospect, Ill., was appointed executive secretary for the group and will maintain the national offices at 34 S. Main St. in Mt. Prospect.

PROMOTED AT GREAT LAKES SCREW CORP.

Jack R. Kruizenga has been elected vice president sales of the Great Lakes Screw Corp.

Kruizenga became associated with Great Lakes last year as assistant to the president. Prior to that time, he had been assistant general sales manager for Trailmobile, Inc.

PRODUCT MANAGER NAMED BY UNITED SHOE

W. Gordon Taylor has been appointed to product manager, eyelets, for the Shelton Division of United Shoe Machinery Corp. In this newly created position, he will coordinate design, development, production and sales activities for United's line of eyelets and eyeleting machines.

Taylor brings to his new position more than 26 years of experience in the fastener industry, all of them with United. He has participated in all facets of the eyelet business, including sales and field technical service.

FASTENER FIRM CHANGES NAME

Howard S. Langdon, president of Indiana Cap & Set Screw Co., announced that company has changed its name to: The Fastron Co.

ROSAN APPOINTS MIDWEST MANAGER

Thomas L. Dodsworth of Detroit, Mich. was named midwest manager of technical sales for Rosan, Inc. west coast manufacturer of fasteners. Prior to his present appointment, he was the company's sales engineer for the midwest area.

Dodsworth will serve as the company's sales and technical representative in nineteen midwestern states and the province of Ontario, Canada. He will maintain his headquarters in Detroit, Mich.

FASTENER REP. MOVES TO NEW OFFICE

A. C. Wahl & Associates, Inc., manufacturers' representative covering southwestern Ohio, Indiana and Kentucky with lines of electronic components and mechanical components, primarily fasteners, has moved its main office in Cincinnati to 315 Reading Road, Cincinnati 15, from 121 Mill Street.

Among fastener lines carried by Wahl, are: Simons Fastener Corp., Automatic Steel Products Corp. and Rotor Clip Corp.

A suggestion award of $56,031, believed to be the largest made through any employee suggestion program, was presented by IBM to two employees of its Data Systems manufacturing plant in Poughkeepsie, N.Y. Production Technician Lawrence R. Livigni, (l), and Departmental Technician Charles G. Glancey (c), show Division President W. B. McWhirter samples of the 14 electronic circuit cards which their suggestion eliminated from the IBM magnetic tape unit in the background.

APPOINTMENTS AT AM. STEEL & WIRE

LONGNECKER

HOXENG

Walter L. Longnecker, former Cleveland district manager of operations was appointed director engineering and research for American Steel and Wire, a division of U.S. Steel Corp. The appointment follows the creation of a combined engineering, research and product development department.

In the new department, Floyd A. Garman will continue to supervise engineering activities as chief engineer.

Dr. Raymond B. Hoxeng has been named director of research of American Steel and Wire. He succeeds Walter O. Everling, who will become research consultant. Everling will assist in coordinating the activities of the three branches.

OMARK NAMES SABIN GENERAL SALES MGR.

Guy E. Sabin has been named general sales manager for Omark Industries, Inc.

In his new position, Sabin, who had been sales manager for Omark's Fastening Division since 1956, now takes charge of all United States sales and service activities for the company's Fastening, Grameweld Stud Welding System and Oregon Saw Chain divisions.

WELDING SOCIETY MEETING IN DALLAS

The American Welding Society fall meeting will be held in the Adolphus Hotel, Dallas, Texas, September 25-28, 1961. Sixteen sessions will be held and a total of 46 technical papers will be presented.

CONTENTS in this issue

Don't overlook these articles

FEATURES

IDEAS AND REPORTS

INDEX TO ADVERTISERS

OUR NATIONAL PURPOSE

National Purpose is not new. A great nation was founded by the men of Concord, who independently and individually wanted liberty but who could not realize their dreams without unified action. Heard around the world was not only a shot, but a declaration of National Purpose as well.

What's happened to our National Purpose over the years? Submerged! Almost smothered under woolly, stuffy apathy! Industrialization, wealth and productive strength have become opiates; success has wafted us on a pink cloud into a world of gaudy peacocks. The other —the real world—is undergoing a second industrial revolution.

That same industrialization which has made our country great is taking place all over the globe. The world is on the march. Others would be great, would be wealthy, and are traveling our road with machines and technology. In this march we have helped. Rarely, in the history of man, has any nation given to others so much of itself, its skills and its knowledge. This we do not regret. Greatness carries its responsibilities and wealth its obligations. And now that others have shared our bread and are strong, we neither condemn nor regret. If we are weakened, it is less from having given than from resting too long.

Alas, history moves faster than we think. Today, a nation becomes industrially mighty in less than ten years instead of 100 years, and becomes a second-rate power just as quickly. Here let us take warning! World industrialization, plus American obsolescence and apathy, means eventually total economic engulfment.

The mere replacement of equipment is not enough. What is needed, in addition, is a National Purpose. The cold realization that those things which need doing to meet world-wide competition are being done because it is a national necessity—that the welfare of the nation depends on this. Personal interests must rise to the highest level of national consciousness. Our eyes must be lifted up and the feeling of greatness and unity be reached at a height far above the immediate competitive advantage level. This we must do. We can do no less, for it is late!

Wm. F. Schleicher

Vice President

A T-Marked SPEED NUT Brand Fastener...

SPEED CLAMPS® go on fast, trim weight and parts handling

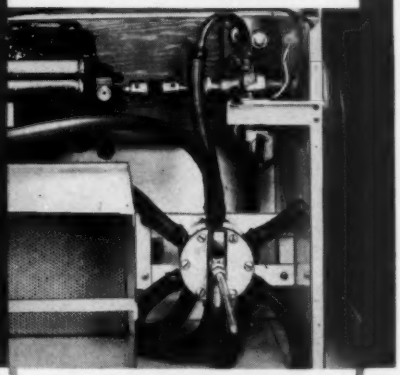
Attachment of tubing is fast and simple with vibration-proof Tinnerman SPEED CLAMPS. They are available in a wide range of sizes and types, with or without attached SPEED NUTS or neoprene flame-resistant cushions. They make firm, secure attachments and allow substantial savings in weight, assembly time and costs.

The complete line of Tinnerman SPEED CLAMPS includes hose clamps, tube clamps, harness clamps, and an assortment of special types to meet various requirements.

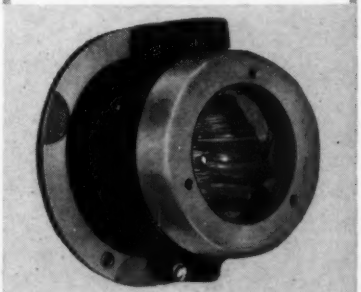
When buying clamps or spring-steel fasteners, look for the T-mark...your assurance that you're putting Tinnerman quality and total reliability into your products. For samples, literature, prices call your local Tinnerman Sales Office . . . listed in the "Yellow Pages" under "Fasteners." Or write to: *Tinnerman Products, Inc., Department 12, Box 6688, Cleveland 1, Ohio.*

T-MARK ENGINEERED SPECIALS

TIME SAVING was the benefit when this Tinnerman Harness Clamp was used to fasten wire bundles to an aircraft structure. Inset shows safe, interlocking tongue and slot that can't spring open accidentally, yet opens readily for servicing without removing clamp from bulkhead.



ASSEMBLY SIMPLIFICATION resulted from a switch to Tinnerman Hose Clamps in this oil changer. One-piece SPEED CLAMPS are easy to apply, quickly secured with standard pliers. Savings in time and labor are substantial, excessive weight and parts handling are eliminated.



GREATER RELIABILITY is attained by television manufacturers with Tinnerman Deflection Yoke Clamps. They eliminate the problem of misalignment and broken connections resulting from rough handling, cushion the tube assembly under live spring tension.

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